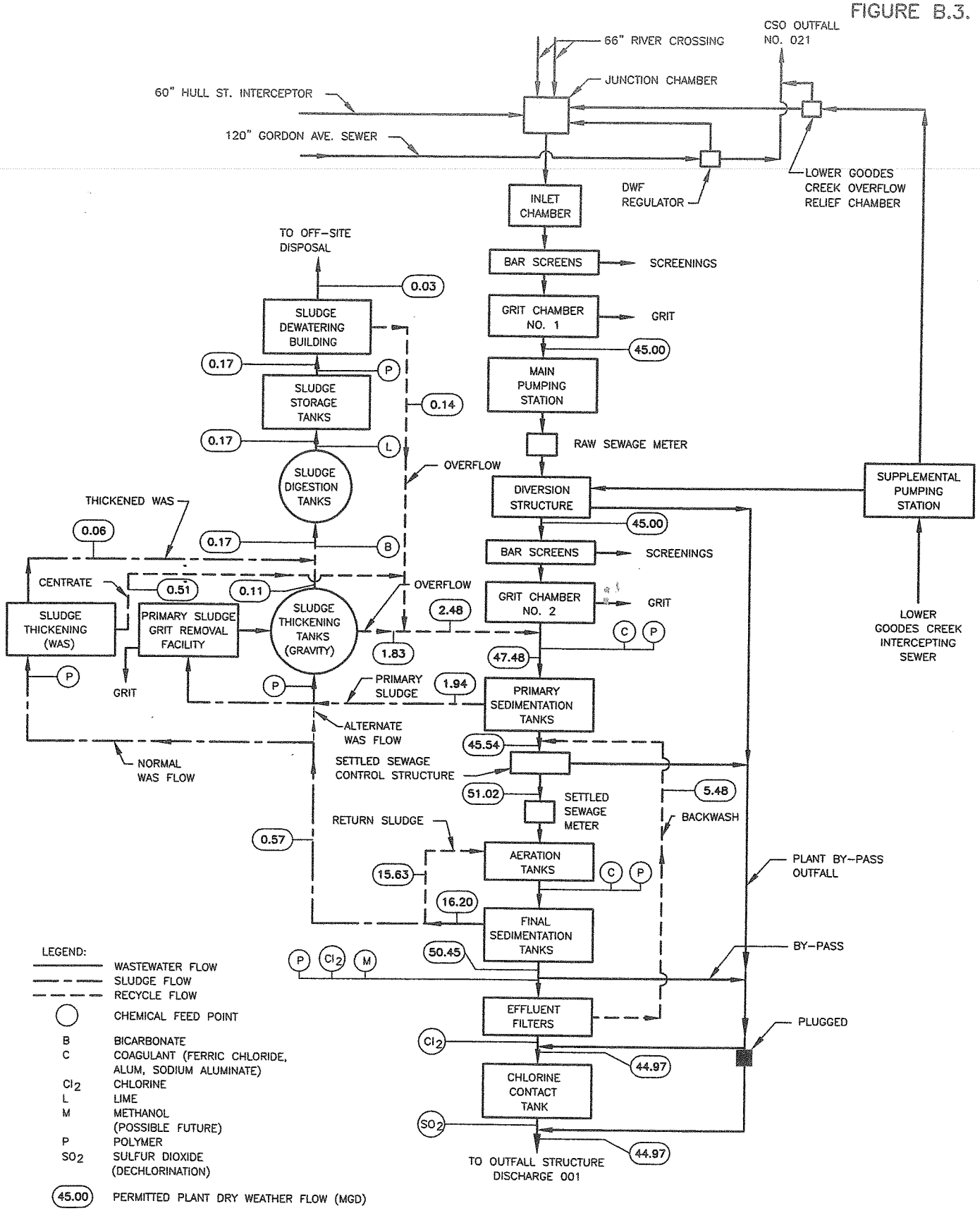
Attachment A

Facility Diagrams

FIGURE B.3.



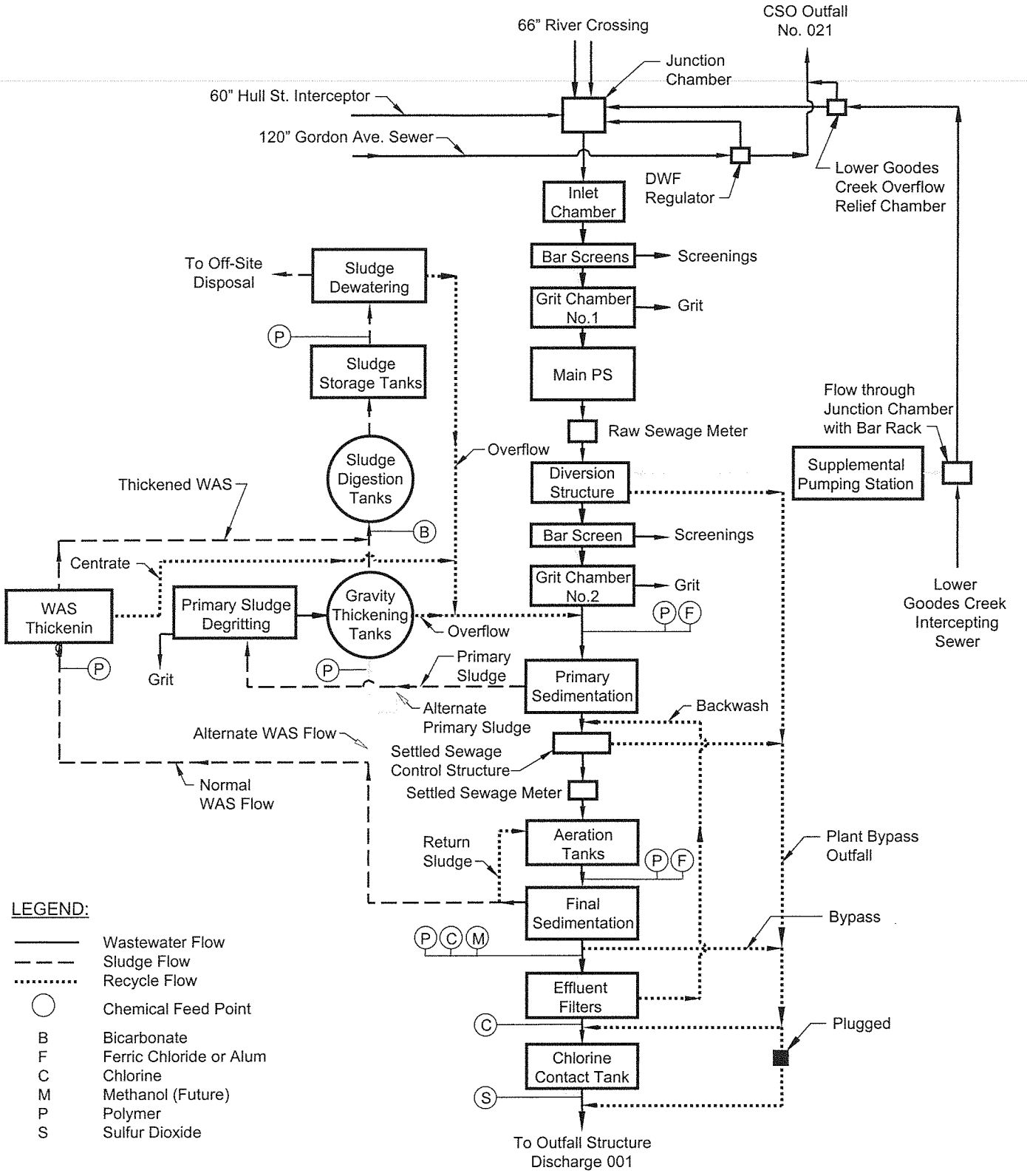
WWTP FLOW DIAGRAM AND WATER BALANCE

CITY OF RICHMOND, VIRGINIA
DEPARTMENT OF PUBLIC UTILITIES
VPDES PERMIT REISSUANCE APPLICATION

GREELEY AND HANSEN LLC

FILE: S:\CLIENTS\RICH\0217E\VPDES\DWGS\FIGURE B.3 1:1 05/20/02 11:57 GH-F

Appendix A - Exhibit 1

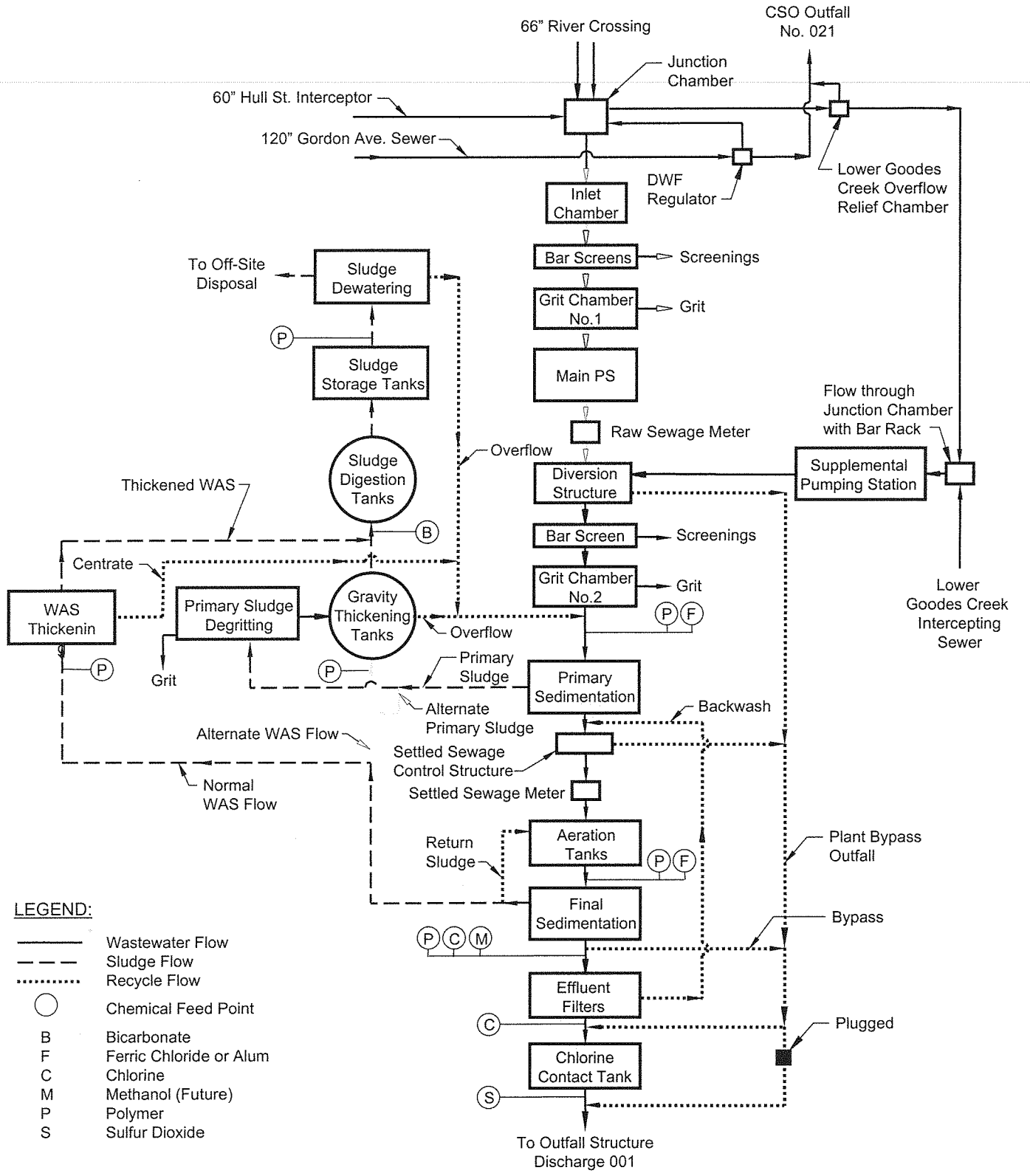


Richmond Wastewater Treatment Plant
Flow Sheet: Normal Operation

City of Richmond, Virginia
Department of Public Utilities
August 2009

Greeley and Hansen LLC

Appendix A - Exhibit 2



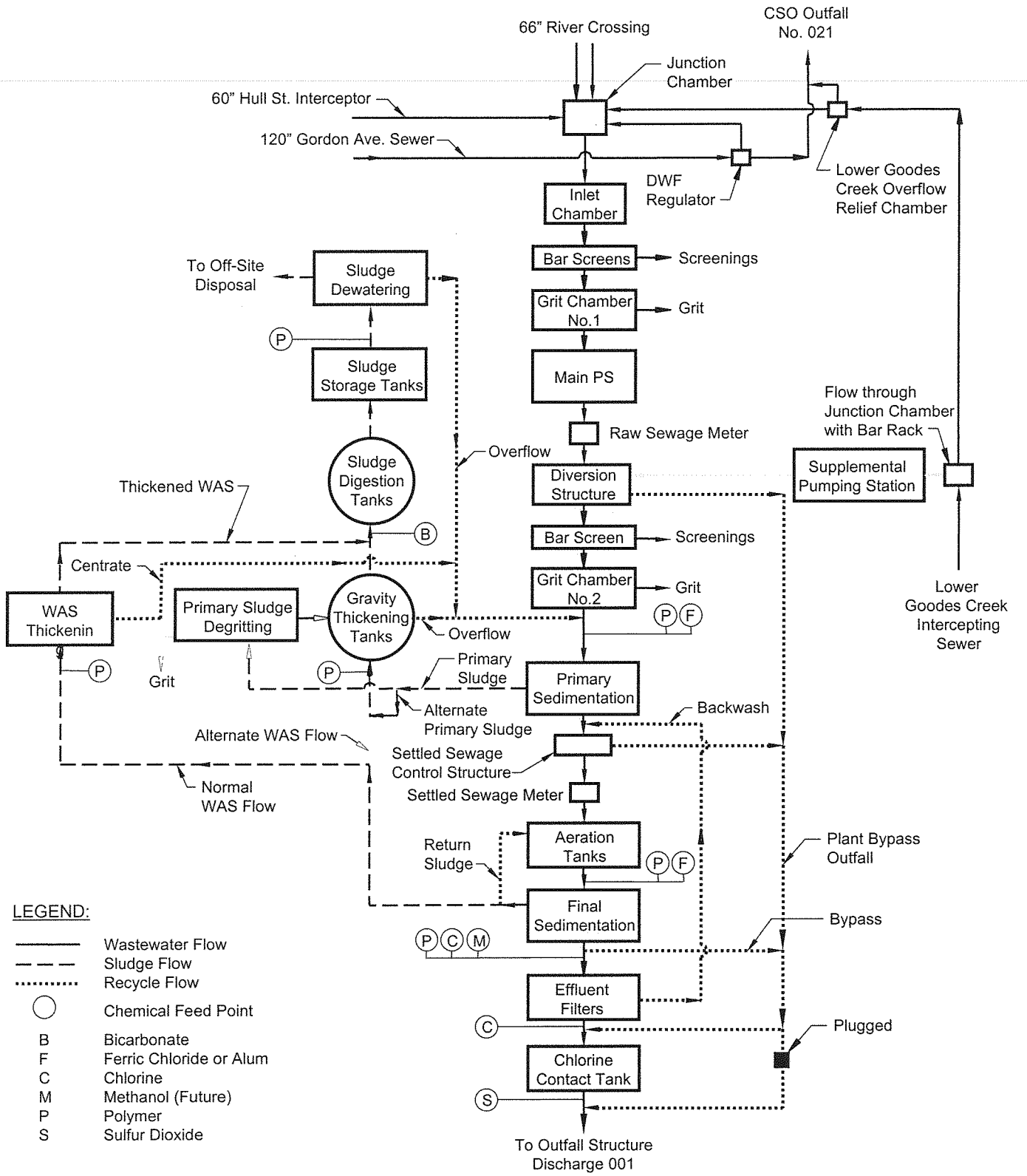
Richmond Wastewater Treatment Plant

Flow Sheet: Main Pumping Station Out of Service

City of Richmond, Virginia
Department of Public Utilities
August 2009

Greeley and Hansen LLC

Appendix A - Exhibit 3



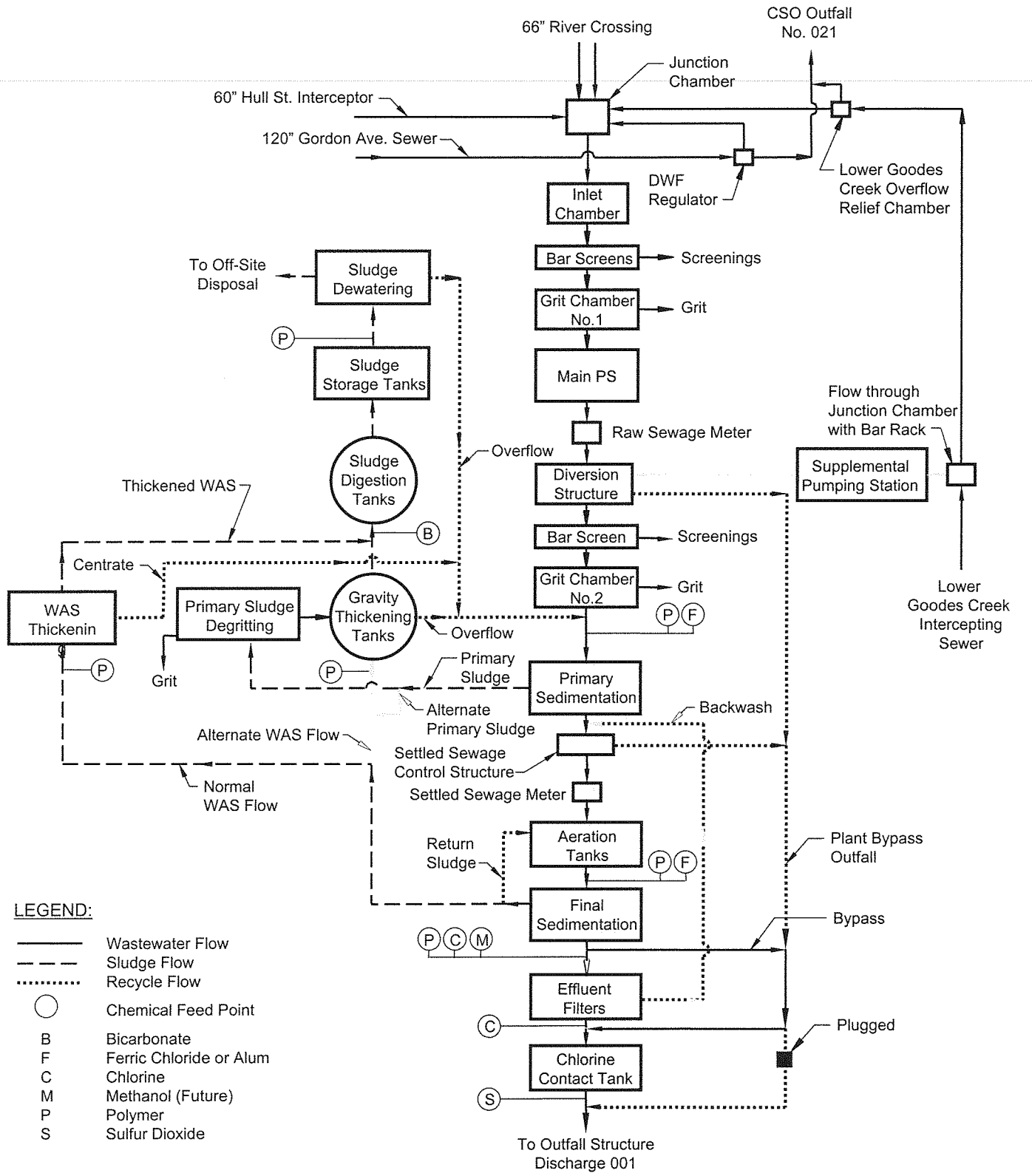
Richmond Wastewater Treatment Plant

Flow Sheet: Primary Sludge Degritting Out of Service

City of Richmond, Virginia
Department of Public Utilities
August 2009

Greeley and Hansen LLC

Appendix A - Exhibit 4

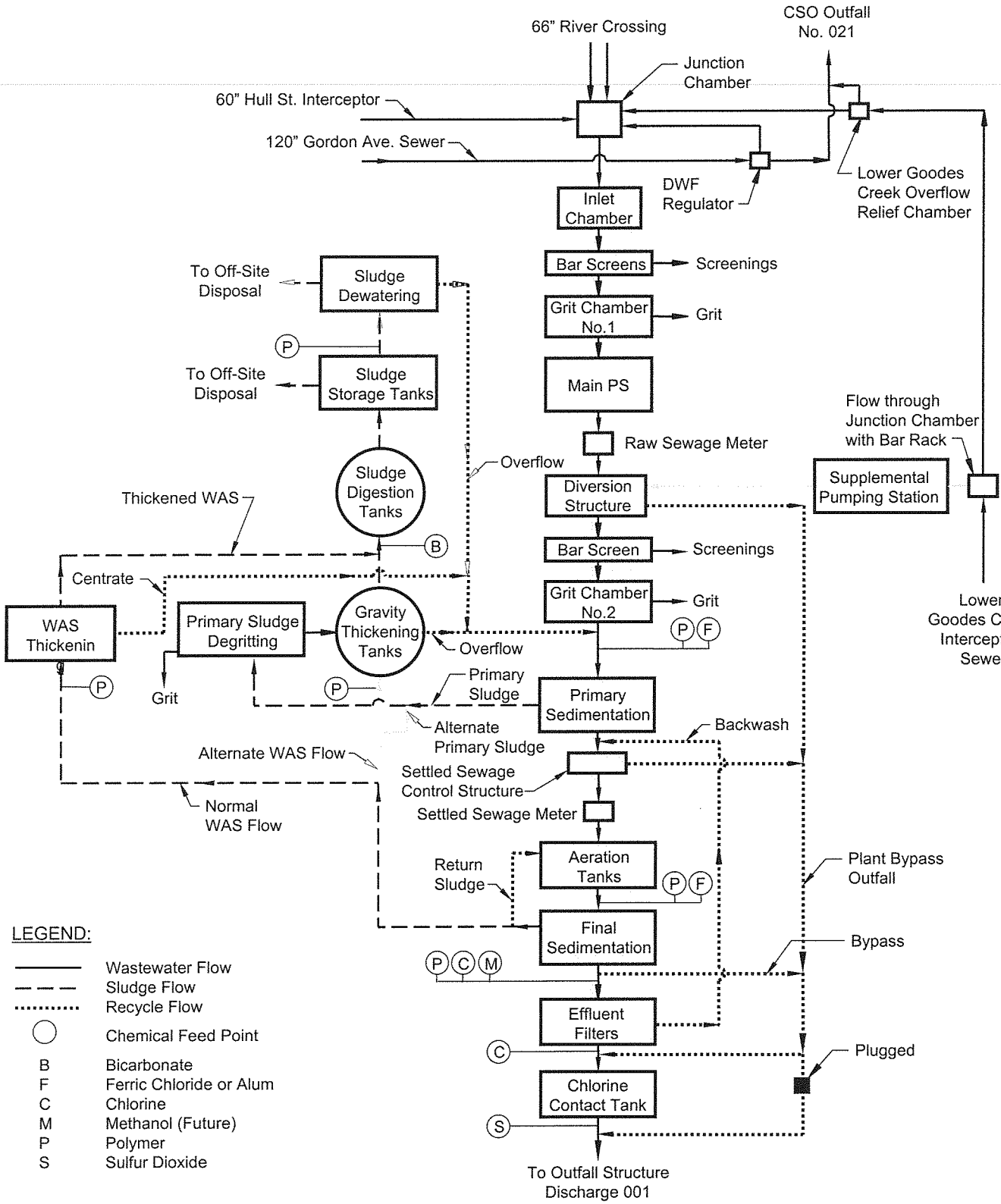


Richmond Wastewater Treatment Plant
Flow Sheet: Bypass Effluent Filter

City of Richmond, Virginia
Department of Public Utilities
August 2009

Greeley and Hansen LLC

Appendix A - Exhibit 5

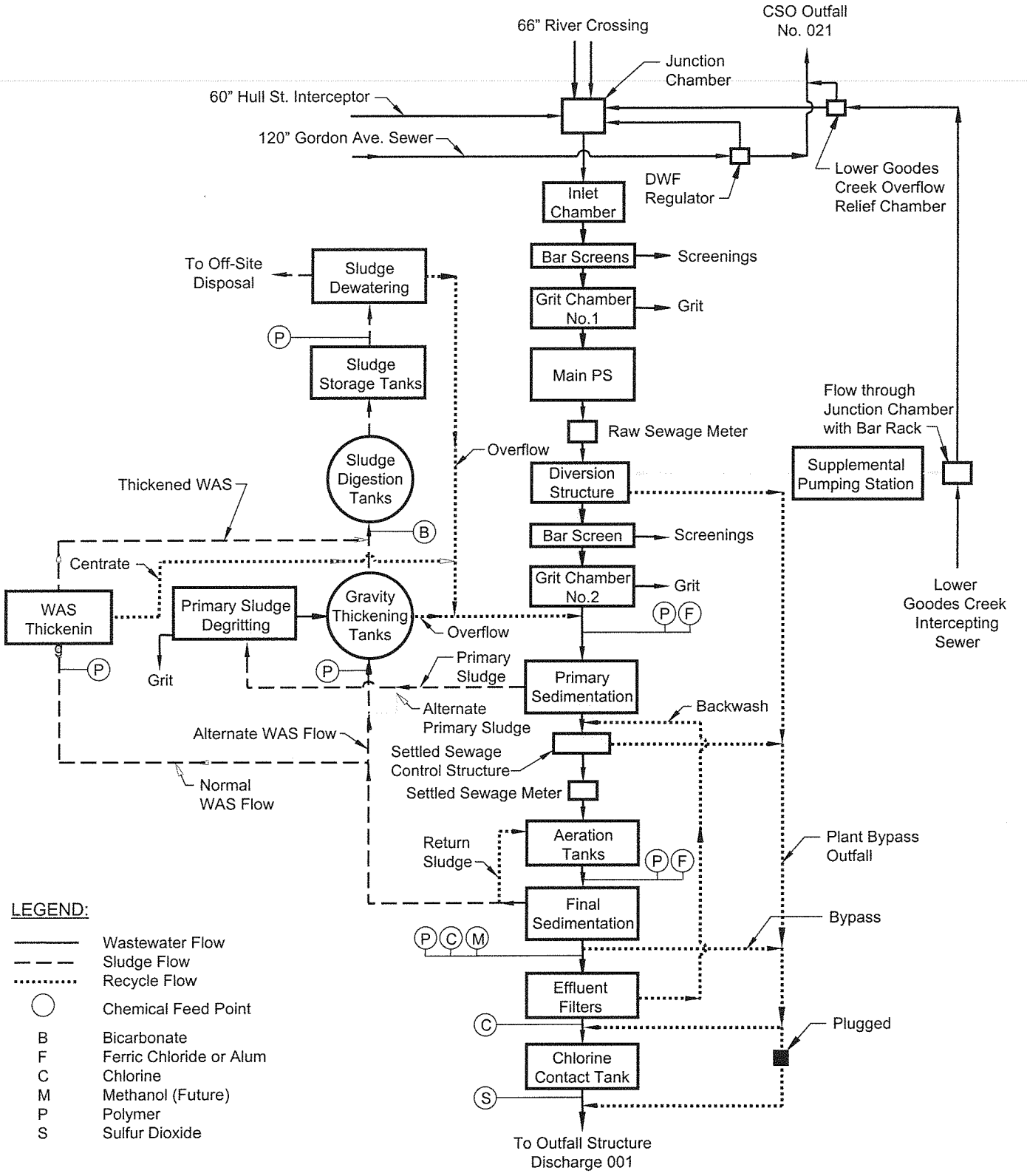


Richmond Wastewater Treatment Plant
Flow Sheet: Sludge Dewatering Out of Service

City of Richmond, Virginia
Department of Public Utilities
August 2009

Greeley and Hansen LLC

Appendix A - Exhibit 6

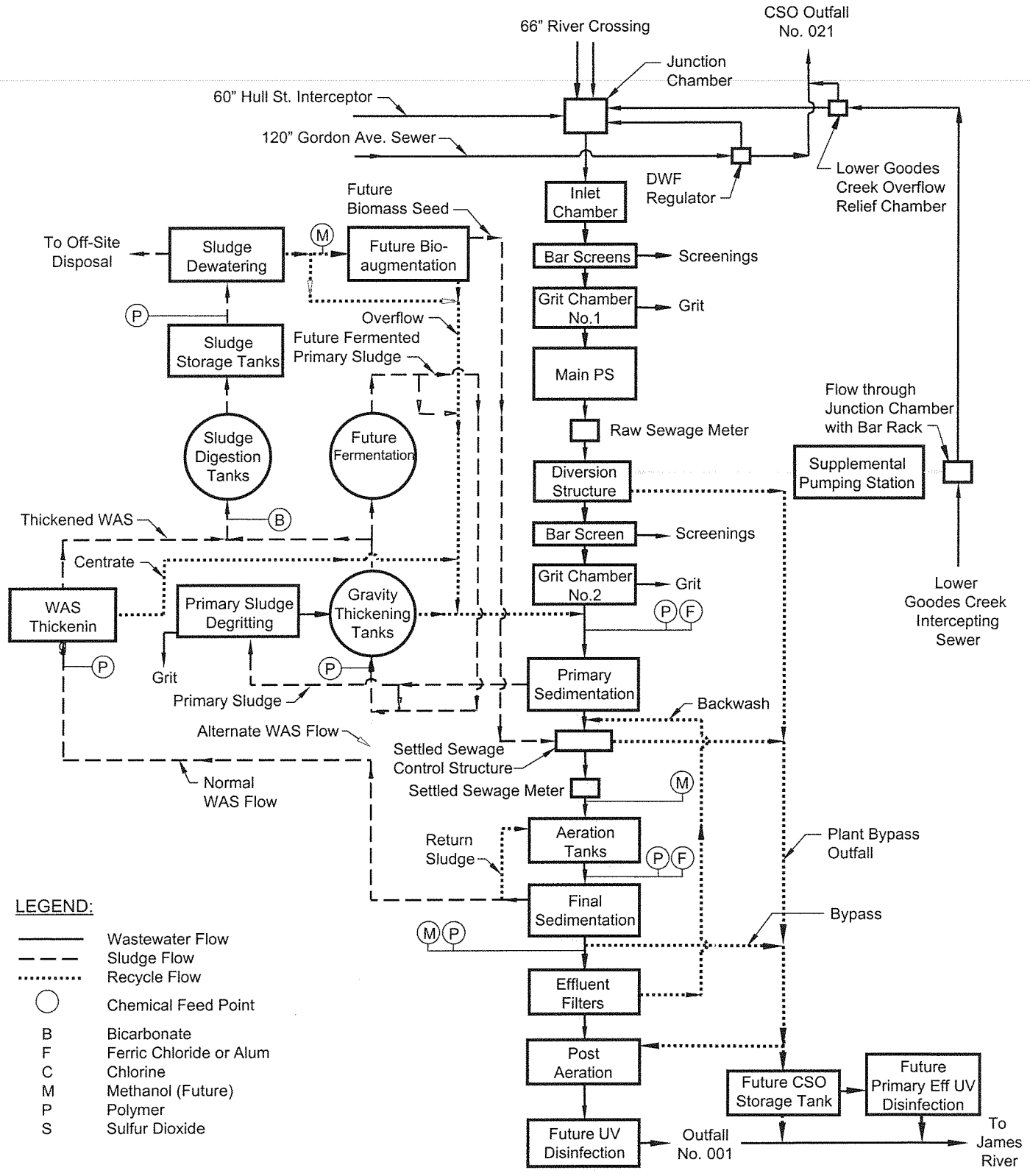


Richmond Wastewater Treatment Plant
Flow Sheet: WAS Thickening Out of Service

City of Richmond, Virginia
Department of Public Utilities
August 2009

Greeley and Hansen LLC

Appendix A - Exhibit 7

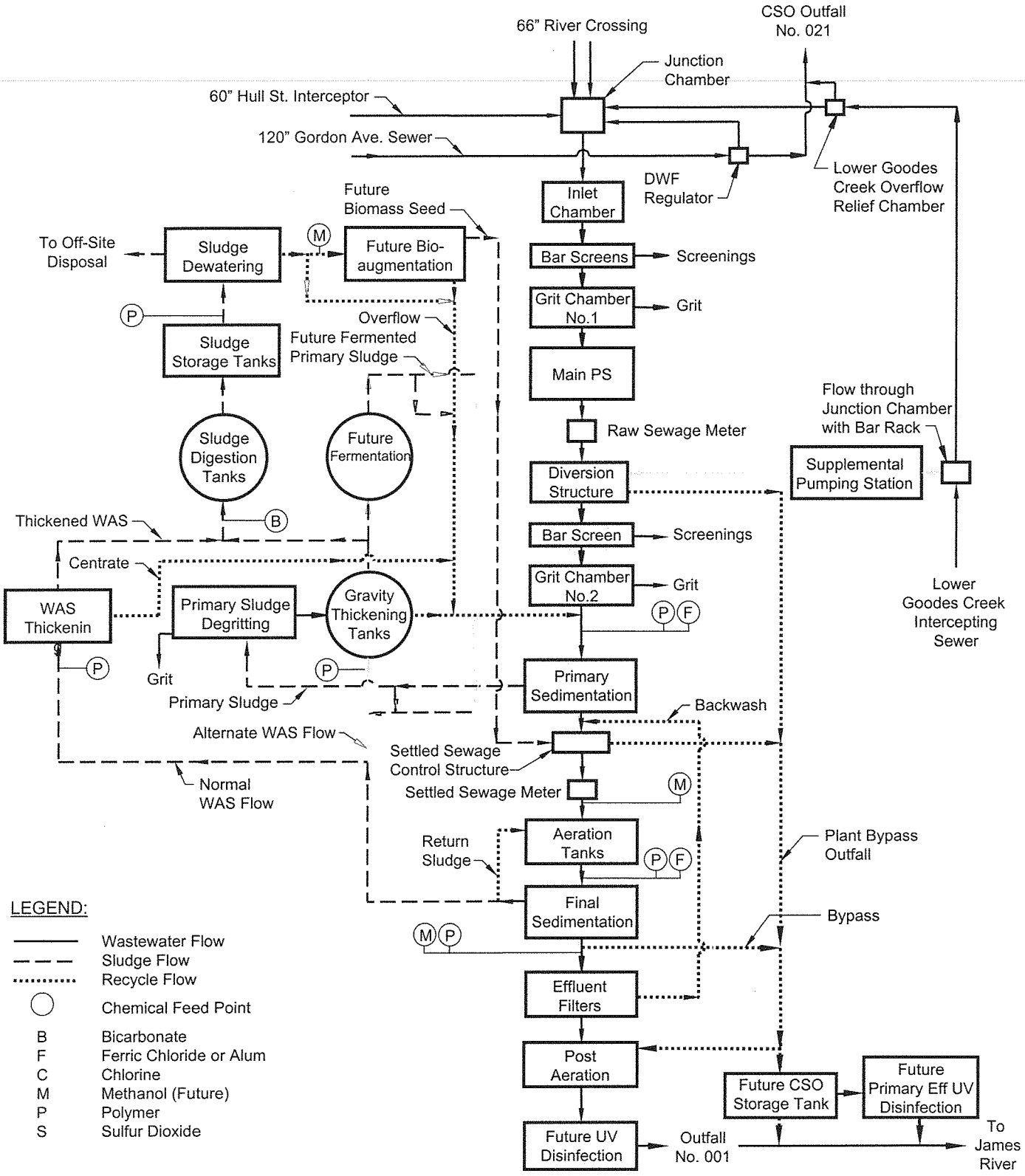


Richmond Wastewater Treatment Plant
Flow Sheet: Future Normal Operation

City of Richmond, Virginia
Department of Public Utilities
August 2009

Greeley and Hansen LLC

Appendix A - Exhibit 8

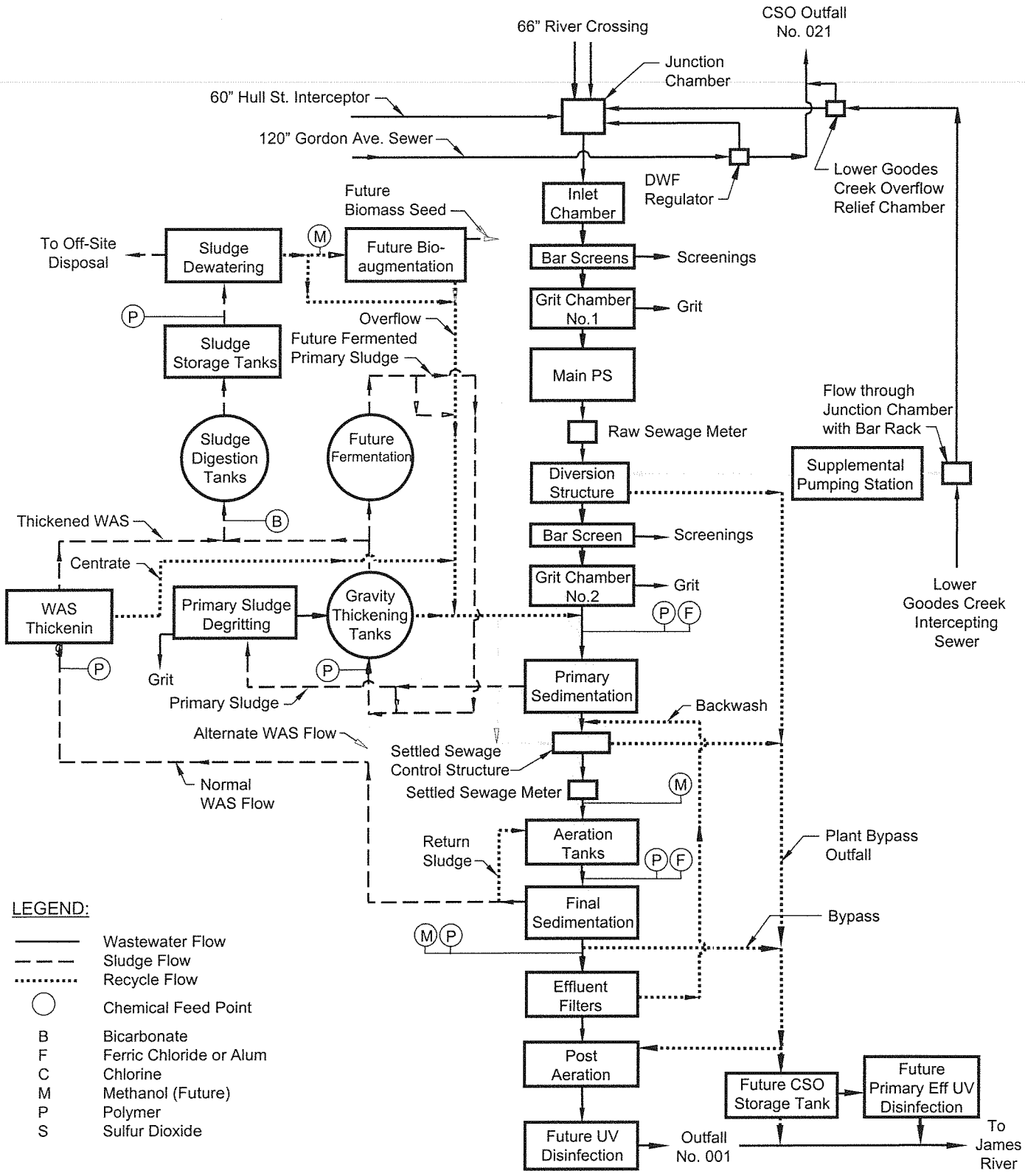


Richmond Wastewater Treatment Plant
Flow Sheet: Future with Fermentation Out of Service

City of Richmond, Virginia
Department of Public Utilities
August 2009

Greeley and Hansen LLC

Appendix A - Exhibit 9



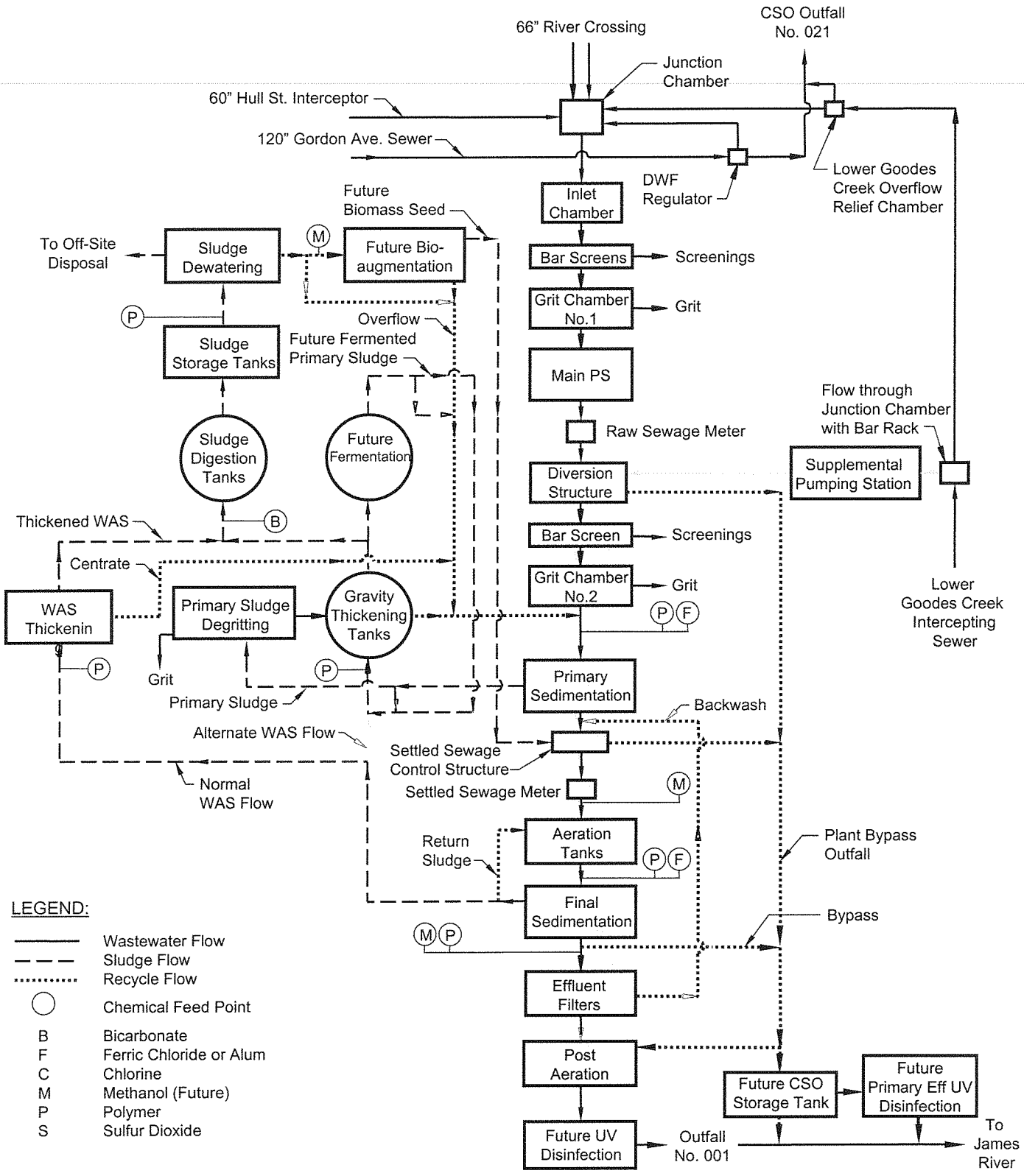
Richmond Wastewater Treatment Plant

Flow Sheet: Future with Bioaugmentation Out of Service

City of Richmond, Virginia
Department of Public Utilities
August 2009

Greeley and Hansen LLC

Appendix A - Exhibit 10

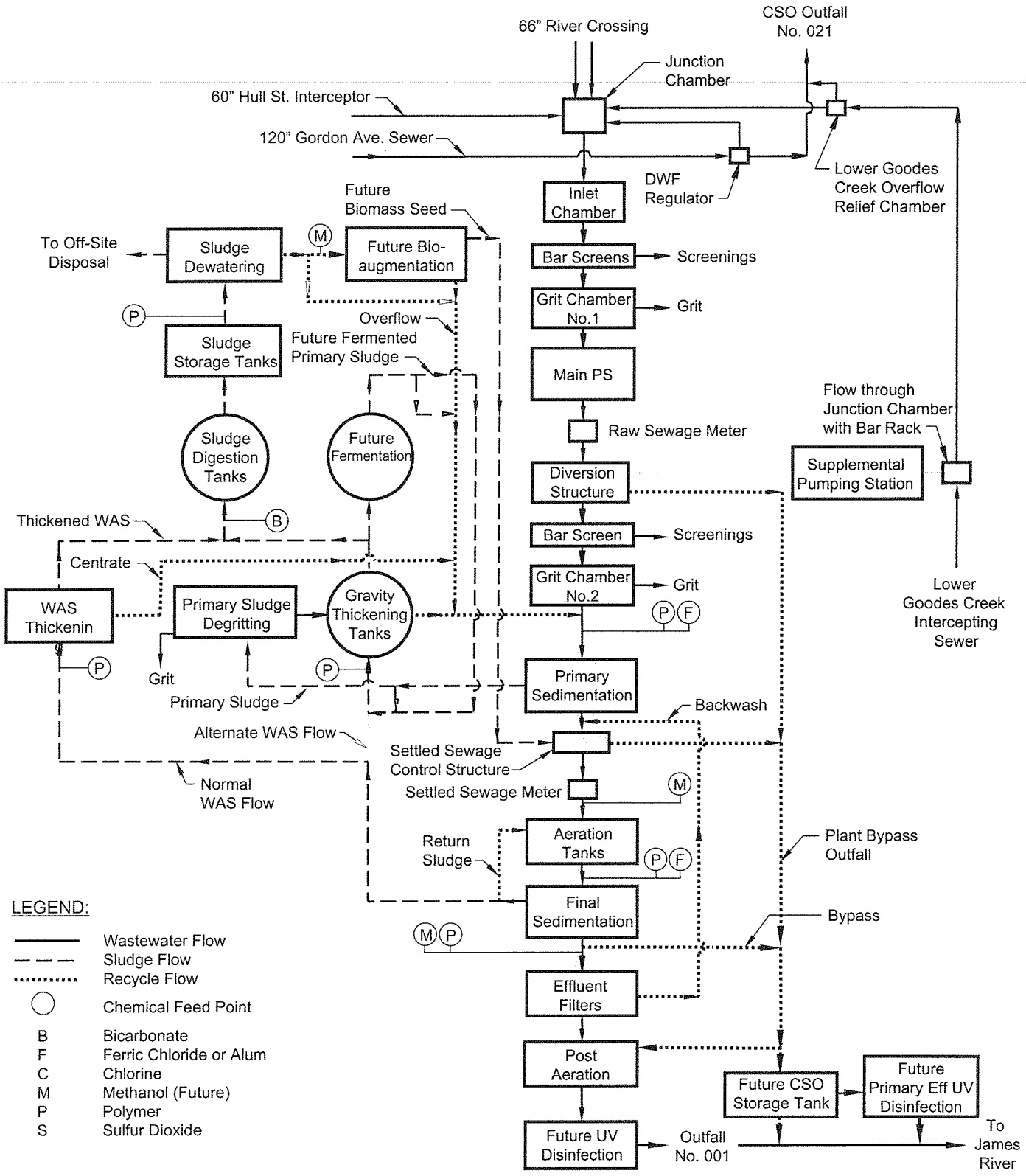


Richmond Wastewater Treatment Plant
Flow Sheet: Future with Filters Out of Service

City of Richmond, Virginia
Department of Public Utilities
August 2009

Greeley and Hansen LLC

Appendix A - Exhibit 11



Richmond Wastewater Treatment Plant

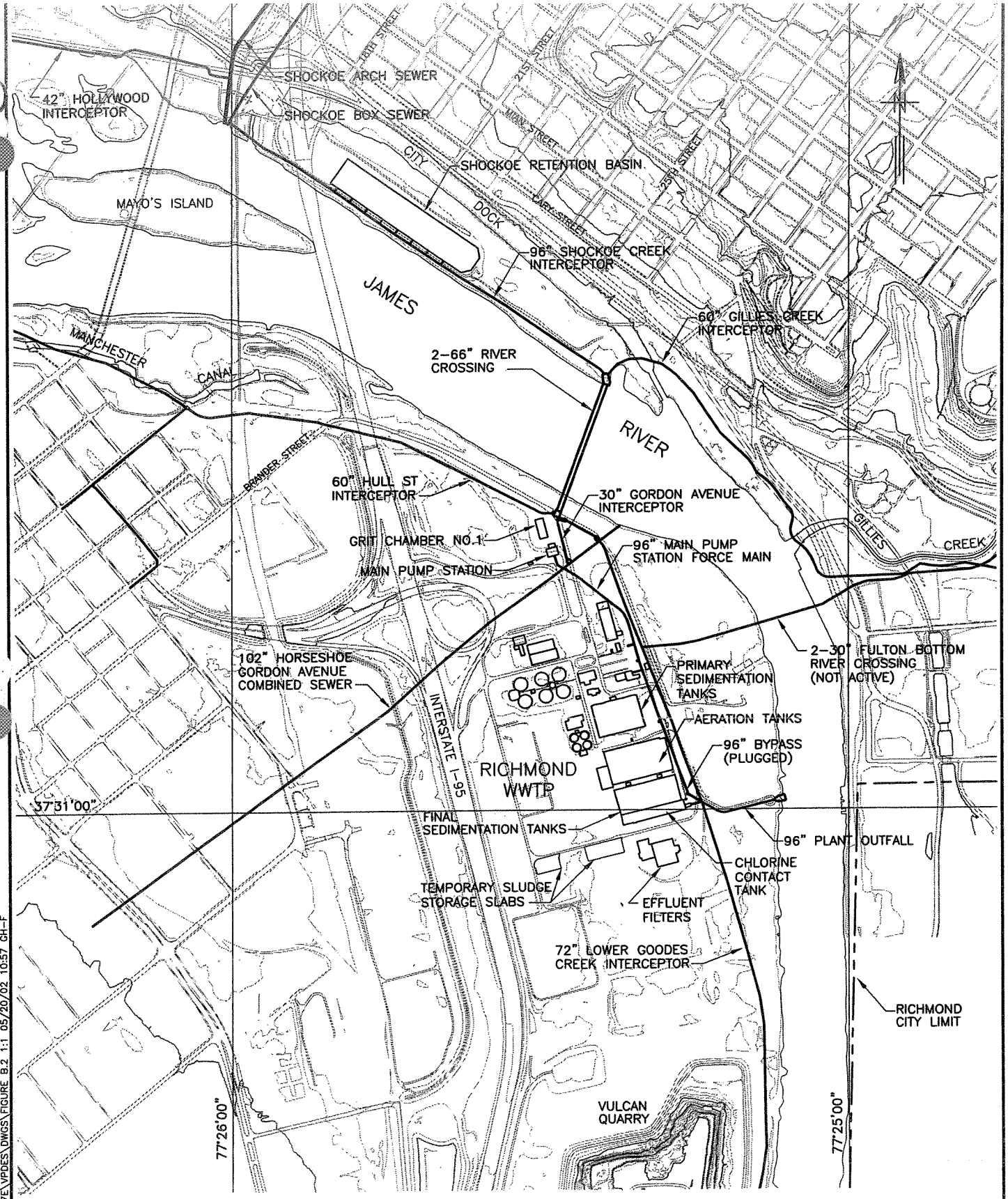
Flow Sheet: Future with Testing of Primary Effluent UV Disinfection

City of Richmond, Virginia
Department of Public Utilities
August 2009

Greeley and Hansen LLC

Attachment B

Location



TOPOGRAPHICAL MAP OF RICHMOND WWTP

SCALE: 1"=1000'

CITY OF RICHMOND, VIRGINIA
DEPARTMENT OF PUBLIC UTILITIES
VPDES PERMIT REISSUANCE APPLICATION

GREELEY AND HANSEN LLC

FILE: ...\0217E\VPDES\DWGS\FIGURE B.2 1:1 05/20/02 10:57 GH-F

Attachment C

Ambient Data

MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL QUALITY
Piedmont Regional Office
4949-A Cox Road Glen Allen, Virginia 23060

SUBJECT: Flow Frequency Determination
City of Richmond WWTP – VA0063177

TO: Gina Kelly, P.E.

FROM: Jennifer Palmore, P.G.

DATE: October 6, 2009

COPIES: File

The City of Richmond's wastewater treatment plant discharges to the James River in Richmond, VA. Outfall 001 is located at rivermile 2-JMS108.83. Flow frequencies have been requested at this site for use in developing effluent limitations for the VPDES permit.

The flow frequencies were developed based on a drainage area comparison between the fall line and the USGS continuous record gage on the James River at the Route 45 bridge in Cartersville (#02035000). Because the discharge is in close proximity to the fall line, the flow is considered approximately equal. The Cartersville gage has been in operation from 1898 through present. However, because the flow in the James is currently regulated by guaranteed released from Gathwright Dam (Lake Moomaw), the flow frequencies for the gage were developed by the Charlottesville office based on data since 1979 only. The data for the reference gage and the fall line are presented below.

James River at Cartersville, VA (#02035000):
Statistical period: 1980-2003
High Flow months: January - May
Drainage area: 6,257 mi^2

1Q30 = 540 cfs	High Flow 1Q10 = 1530 cfs
1Q10 = 638 cfs	High Flow 7Q10 = 1810 cfs
7Q10 = 717 cfs	High Flow 30Q10 = 2220 cfs
30Q10 = 918 cfs	HM = 3020 cfs
30Q5 = 1020 cfs	

James River at fall line:
Drainage Area: 6,755 mi^2

1Q30 = 583 cfs (377 MGD)	High Flow 1Q10 = 1652 cfs (1068 MGD)
1Q10 = 689 cfs (445 MGD)	High Flow 7Q10 = 1954 cfs (1263 MGD)
7Q10 = 774 cfs (500 MGD)	High Flow 30Q10 = 2397 cfs (1549 MGD)
30Q10 = 991 cfs (641 MGD)	HM = 3260 cfs (2107 MGD)
30Q5 = 1101 cfs (712 MGD)	

This analysis does not address withdrawals, discharges, or springs influencing the flow of the James River between Cartersville and the fall line.

The segment of the James River to which the city discharges was considered a Category 5A water (impaired and needing a TMDL) during the 2008 Water Quality Assessment. The applicable fact sheets are attached. The river is impaired for the Recreation Use due to E. coli violations; this TMDL is currently under development and includes draft wasteload allocations of 1.48E+14 E. coli cfu/year and 4.06E+11 E. coli cfu/day for the wastewater plant outfall 001. (The Combined Sewer Overflows receive separate, additional allocations.) The Fish Consumption Use is impaired due to a VDH Fish Consumption Advisory for PCBs; this TMDL is due in 2014. The Aquatic Life Use is impaired due to inadequate submerged aquatic vegetation (SAV) in the upper tidal freshwater James River estuary and high chlorophyll a in the James mainstem; the TMDLs are due by 2010 and will be addressed as part of the Chesapeake Bay TMDL.

In addition, mercury exceeded the screening value for fish tissue and the river is under a VDH Fish Consumption Advisory for kepone. These are non-impairing "observed effects". The Wildlife Use was assessed as fully supporting.

The James River between Richmond and Hopewell is considered a Tier 1 water because existing water quality management plans allow the dissolved oxygen to drop to 5.0 mg/L at critical conditions.

Monitoring data for station 2-JMS110.30 is attached. The station is located at Mayo's Bridge, approximately 1.5 miles upstream of the outfall.

If you have any questions concerning this analysis, please let me know.

Adjusted Flows Illustrating Richmond and Henrico Water Treatment Plants (WTPs) Withdrawals

Adjusted Flow = Unadulterated Flow – Withdrawals + Discharges

Ex. Adjusted Flow = 445 MGD – 106.2 MGD Richmond WTP – 38.6 MGD Henrico WTP = 300 MGD

Flow Type	Flow	Adjusted Flow
	Low Flows	
1Q10	445	300
7Q10	500	355
30Q10	641	496
30Q5	712	567
	High Flows	
1Q10	1068	923
7Q10	1263	1118
30Q10	1549	1404
HM	2107	1962

Low flows are from June – December while high flows are from January – May.

City of Richmond Water Withdrawals (MG)

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual	Max Day
2003	2549	2253	2447	2425	2460	2461	3028	2852	2670	2783	2345	2269	30542	114.1
2004	2363	2203	2405	2448	2413	2380	2364	2241	2219	2116	1961	2006	27119	108.4
2005	2035	1807	1996	2056	2063	2618	2786	2696	2720	2373	2070	2036	27256	108.6
2006	1897	1687	1938	2154	2416	2584	2620	2813	2160	2016	1762	1820	25867	106.6
2007	1750	1687	1812	1895	2136	2348	2619	2637	2526	2391	1871	1828	25500	98.3
2008	1805	1646	1814	1893	2059	2633	2673	2777	2318	2201	1895	1826	25540	100.9
Mo avg	2066.5	1880.5	2068.7	2145.2	2257.8	2504.0	2681.7	2669.3	2435.5	2313.3	1984.0	1964.2		106.2

Avg Max Day = 106.2 MGD

Henrico County Water Withdrawals (MG)

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual	Max Day
2003	0	0	0	5.7	0	0	48.1	467.1	312.5	459.1	523.9	548.8	2365.2	20.6
2004	439	469	354	462	644	623	581	528	496	585	518	465	6164	30
2005	440.4	416.2	439.1	476.2	651.9	858.6	964.5	929.2	1153.1	828.6	640.1	503.7	8301.6	42.6
2006	559.4	537	621.4	749.8	906.5	956.2	1086.1	1202.5	885.9	784.9	612.8	578.5	9481	50.1
2007	574.9	561.6	630.2	740.7	964.4	1056.5	1166	1109.1	1166.2	1126.3	681.8	613.6	10391.3	43.7
2008	611.9	537	604.5	636	795.6	1139.3	1107.4	1180.4	863.5	819.2	556.1	499.6	9350.5	44.7
Mo avg	437.6	420.1	441.5	511.7	660.4	772.3	825.5	902.7	812.9	767.2	588.8	534.9		38.6

Avg Max Day = 38.6 MGD

Summed Avg Max Days = 144.8 MGD

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	2/18/1968	S	0.3	2.78	8			10.5
2-JMS110.30	4/23/1968	S	0.3	20.56	8.5			7.5
2-JMS110.30	6/18/1968	S	0.3	25.56	8			7.5
2-JMS110.30	7/21/1968	S	0.3	30	8.4			15
2-JMS110.30	8/20/1968	S	0.3	29.44	8			8.3
2-JMS110.30	9/6/1968	S	0.3	25.56	8.5			7.5
2-JMS110.30	10/7/1968	S	0.3	17.78	8.5			5.5
2-JMS110.30	1/20/1969	S	0.3	2.22	7.3			14
2-JMS110.30	4/17/1969	S	0.3	20	7.5			8.2
2-JMS110.30	7/16/1969	S	0.3	27.78	7.7			7.4
2-JMS110.30	2/9/1970	S	0.3	4.44	7.3			12.39
2-JMS110.30	3/24/1970	S	0.3	8.89	6.2			11.19
2-JMS110.30	4/22/1970	S	0.3	14.44	6.8			8.84
2-JMS110.30	5/6/1970	S	0.3	14.44	7.2			8.5
2-JMS110.30	6/29/1970	S	0.3	25	7.9			8.2
2-JMS110.30	7/10/1970	S	0.3	25.56	7.4			7.6
2-JMS110.30	8/20/1970	S	0.3	24.44	7.5			7.8
2-JMS110.30	9/21/1970	S	0.3	26.67	7.5			9.8
2-JMS110.30	10/27/1970	S	0.3	16.67	8.5			10.59
2-JMS110.30	11/23/1970	S	0.3	3.33	5.5			9
2-JMS110.30	12/15/1970	S	0.3	5.56	6.7			12.39
2-JMS110.30	1/18/1971	S	0.3	4.44	7			12
2-JMS110.30	2/14/1971	S	0.3					
2-JMS110.30	3/15/1971	S	0.3	12.78	7.6			11
2-JMS110.30	4/28/1971	S	0.3	14.44	7.3			8.4
2-JMS110.30	5/13/1971	S	0.3	20	8.1			8.4
2-JMS110.30	6/27/1971	S	0.3	28.89	8.7			7.8
2-JMS110.30	7/8/1971	S	0.3	27.78	8			7.6
2-JMS110.30	8/2/1971	S	0.3	27.78	8.7			8.4
2-JMS110.30	9/23/1971	S	0.3	21.11	8.2			8.2
2-JMS110.30	10/5/1971	S	0.3	22.22	8.1			9.8
2-JMS110.30	11/29/1971	S	0.3	5.56	7.3			13.19
2-JMS110.30	12/20/1971	S	0.3	4.44	7			10.59
2-JMS110.30	1/20/1972	S	0.3	5	7.3			10.39
2-JMS110.30	2/10/1972	S	0.3	1.11				
2-JMS110.30	3/20/1972	S	0.3	11.67	7			
2-JMS110.30	4/4/1972	S	0.3	12.22	7.5			10.59
2-JMS110.30	5/5/1972	S	0.3	13.33	6.7			8.4
2-JMS110.30	7/14/1972	S	0.3	27.22	7.8			8.1
2-JMS110.30	8/17/1972	S	0.3	25.56	7.7			9
2-JMS110.30	9/26/1972	S	0.3	24.44	8.2			7.8
2-JMS110.30	10/26/1972	S	0.3	13.33	8.8			10
2-JMS110.30	11/27/1972	S	0.3	6.11	7.2			10.39
2-JMS110.30	12/12/1972	S	0.3	8.89	7			11.39
2-JMS110.30	1/29/1973	S	0.3	6.67	7.2			12.39
2-JMS110.30	2/20/1973	S	0.3	3.33	7.5			13.39
2-JMS110.30	3/30/1973	S	0.3	11.11	7.5			11
2-JMS110.30	4/18/1973	S	0.3	14.44	7.3			9.8
2-JMS110.30	7/2/1973	S	0.3	28.89	7.1			8.8
2-JMS110.30	9/19/1973	S	0.3	22.22	8			8
2-JMS110.30	10/19/1973	S	0.3	17.22	8.6			10.19
2-JMS110.30	10/24/1973	S	0.3	20	8.5			10
2-JMS110.30	11/26/1973	S	0.3	11.67	8.5			10.59
2-JMS110.30	12/5/1973	S	0.3	13.33	7.4			10
2-JMS110.30	1/13/1974	S	0.3	11.11	7.7			11.19
2-JMS110.30	1/22/1974	S	0.3	10	7.4			11.19

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	3/18/1974	S	0.3	7.22	7			11.39
2-JMS110.30	4/2/1974	S	0.3	14.44	7.5			10.39
2-JMS110.30	5/26/1974	S	0.3	21.11	8.5			8.3
2-JMS110.30	5/27/1974	S	0.3	18.89	7.5			8
2-JMS110.30	6/2/1974	S	0.3		7.5			10.39
2-JMS110.30	6/7/1974	S	0.3	21.67	7.5			8.6
2-JMS110.30	6/27/1974	S	0.3	23.89	8			9
2-JMS110.30	7/21/1974	S	0.3	26.67	8.5			9.6
2-JMS110.30	8/22/1974	S	0.3	27.78	7.7			7.4
2-JMS110.30	9/25/1974	S	0.3	17.78	8			9.2
2-JMS110.30	10/15/1974	S	0.3	18.89	7.5			11.59
2-JMS110.30	11/26/1974	S	0.3	6.67	7			15
2-JMS110.30	1/23/1975	S	0.3	5.56	7.5			14.19
2-JMS110.30	2/7/1975	S	0.3	6.67	7.5			12
2-JMS110.30	3/24/1975	S	0.3	13.33	7			8
2-JMS110.30	4/17/1975	S	0.3	13.89				9.6
2-JMS110.30	5/12/1975	S	0.3	21.11	7.7			9.6
2-JMS110.30	6/9/1975	S	0.3	25.56	8.5			8.2
2-JMS110.30	7/13/1975	S	0.3	24.44	7.5			7.8
2-JMS110.30	8/6/1975	S	0.3		7.8			7.2
2-JMS110.30	9/21/1975	S	0.3	25.56	8.7			8
2-JMS110.30	10/25/1975	S	0.3	17.22	7.9			9.3
2-JMS110.30	11/18/1975	S	0.3	12.22	9			11.39
2-JMS110.30	12/4/1975	S	0.3	10	8			12.79
2-JMS110.30	1/15/1976	S	0.3	4.44	7			14.5
2-JMS110.30	2/11/1976	S	0.3	6.67	7.5			12.79
2-JMS110.30	3/2/1976	S	0.3	14.44	8			10.79
2-JMS110.30	4/7/1976	S	0.3	14.44	8.2			10
2-JMS110.30	5/7/1976	S	0.3	20	9			9.3
2-JMS110.30	6/29/1976	S	0.3		8			8.2
2-JMS110.30	7/16/1976	S	0.3	28.89	8.2			7.9
2-JMS110.30	8/19/1976	S	0.3	25.56	9			9.5
2-JMS110.30	9/17/1976	S	0.3	25	8.8			8.5
2-JMS110.30	10/1/1976	S	0.3	20	7.5			8.2
2-JMS110.30	11/22/1976	S	0.3	7.22	9			12.39
2-JMS110.30	12/17/1976	S	0.3	6.11	7.5			10.19
2-JMS110.30	1/28/1977	S	0.3	3	8.7			13
2-JMS110.30	3/8/1977	S	0.3	11	8			10.19
2-JMS110.30	4/15/1977	S	0.3	13	7.5			8.7
2-JMS110.30	5/27/1977	S	0.3	2.1	8.9			7.6
2-JMS110.30	6/15/1977	S	0.3					
2-JMS110.30	6/17/1977	S	0.3					
2-JMS110.30	7/18/1977	S	0.3	3.3	9			9
2-JMS110.30	8/25/1977	S	0.3	2.5	9			8.6
2-JMS110.30	11/21/1977	S	0.3	0	8			11
2-JMS110.30	3/23/1978	S	0.3	17	7.8			9.8
2-JMS110.30	4/25/1978	S	0.3	16	8.9			8.9
2-JMS110.30	5/23/1978	S	0.3	3	8.5			8.6
2-JMS110.30	6/7/1978	S	0.3	1	9			7.6
2-JMS110.30	8/8/1978	S	0.3		7.5			7
2-JMS110.30	9/8/1978	S	0.3	29	9.3			7.5
2-JMS110.30	10/25/1978	S	0.3	15.5	8			11.6
2-JMS110.30	11/1/1978	S	0.3	17	8.7			8.8
2-JMS110.30	11/1/1978	S	0.3	17	8.7			8.8
2-JMS110.30	1/17/1979	S	0.3	4.5	7.1			11.8
2-JMS110.30	3/16/1979	S	0.3	6	8			11.3

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	4/5/1979	S	0.3	9	8.8			9.2
2-JMS110.30	6/7/1979	S	0.3	22	7.9			8.7
2-JMS110.30	8/15/1979	S	0.3	26	7.5			9
2-JMS110.30	9/11/1979	S	0.3	22.5	7.8			8.2
2-JMS110.30	10/25/1979	S	0.3	15.5	8.6			9.2
2-JMS110.30	11/27/1979	S	0.3	14	8.4			9.1
2-JMS110.30	12/13/1979	S	0.3	10.5	8			15.2
2-JMS110.30	1/23/1980	S	0.3	6	6.5			11.2
2-JMS110.30	2/5/1980	S	0.3	2.5	8			12.4
2-JMS110.30	3/11/1980	S	0.3	10.5	7.8			10.3
2-JMS110.30	4/8/1980	S	0.3	13.5	7.5			10.8
2-JMS110.30	5/7/1980	S	0.3	17.5	8.2			10.2
2-JMS110.30	6/11/1980	S	0.3	24	8.8			8.1
2-JMS110.30	7/9/1980	S	0.3	24	7.5			7.2
2-JMS110.30	8/7/1980	S	0.3	32.5	9			7
2-JMS110.30	9/11/1980	S	0.3	23	9			9.3
2-JMS110.30	10/9/1980	S	0.3	19.5	9			10.5
2-JMS110.30	12/11/1980	S	0.3	7.5	9			13
2-JMS110.30	2/12/1981	S	0.3	3	8.6			13
2-JMS110.30	3/12/1981	S	0.3	6	7.5			12
2-JMS110.30	4/9/1981	S	0.3	15	8.9			9.7
2-JMS110.30	5/6/1981	S	0.3	20	8.5			8.7
2-JMS110.30	6/9/1981	S	0.3	28	8.4			7.9
2-JMS110.30	7/7/1981	S	0.3	25	8			7.6
2-JMS110.30	8/18/1981	S	0.3	26	8.6			8.5
2-JMS110.30	9/8/1981	S	0.3	26	8.5			8.5
2-JMS110.30	10/20/1981	S	0.3	15	8.7			8.2
2-JMS110.30	11/4/1981	S	0.3	15	8.3			7
2-JMS110.30	12/1/1981	S	0.3	5	7.5			9.7
2-JMS110.30	1/12/1982	S	0.3	0.5	6.8			10.4
2-JMS110.30	2/16/1982	S	0.3	8	7.5			9.7
2-JMS110.30	3/17/1982	S	0.3	12	7.5			9.1
2-JMS110.30	4/21/1982	S	0.3	17.5	7.9			7.6
2-JMS110.30	5/18/1982	S	0.3	26	7.8			6.9
2-JMS110.30	6/22/1982	S	0.3	24	7			6.5
2-JMS110.30	7/19/1982	S	0.3	31	8			7
2-JMS110.30	8/15/1982	S	0.3	26	7.8			6.9
2-JMS110.30	9/22/1982	S	0.3	21	8.8			9.4
2-JMS110.30	10/27/1982	S	0.3	14	7			10.8
2-JMS110.30	11/23/1982	S	0.3	13	8.9			11.7
2-JMS110.30	12/20/1982	S	0.3	12	7.2			12.2
2-JMS110.30	1/20/1983	S	0.3	1	9.3			14.8
2-JMS110.30	2/24/1983	S	0.3	7.5	7.3			12.1
2-JMS110.30	3/10/1983	S	0.3	10	7.3			10.8
2-JMS110.30	4/12/1983	S	0.3	12.5	7.5			10.8
2-JMS110.30	5/10/1983	S	0.3	20.5	9			12.6
2-JMS110.30	6/16/1983	S	0.3	30	8.7			8.5
2-JMS110.30	7/20/1983	S	0.3	33	8			8
2-JMS110.30	7/28/1983	S	0.91					
2-JMS110.30	8/16/1983	S	0.91	25.5	8.6			9.9
2-JMS110.30	8/30/1983	S	0.91					
2-JMS110.30	9/20/1983	S	0.91					
2-JMS110.30	9/21/1983	S	0.3	22.5	9			9.4
2-JMS110.30	9/27/1983	S	0.91					
2-JMS110.30	10/3/1983	S	0.91	20.5	8			6.5
2-JMS110.30	10/12/1983	S	0.91					

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	11/29/1983	S	0.3	10				11.5
2-JMS110.30	12/22/1983	S	0.3	4	7			13.6
2-JMS110.30	2/14/1984	S	0.3	10.5	7.9			10.9
2-JMS110.30	3/19/1984	S	0.3	11	6.9			10.8
2-JMS110.30	5/25/1984	S	0.3	28	8.1			8.6
2-JMS110.30	5/29/1984	S	0.3	23.5	6.6			9.1
2-JMS110.30	7/11/1984	S	19	24		0.8		
2-JMS110.30	7/11/1984	S	1	24		7.9		
2-JMS110.30	7/12/1984	S	1	29	7.4	8		
2-JMS110.30	7/30/1984	S	0.3	24.5	7.1			8.5
2-JMS110.30	7/31/1984	S	1	26	8.4	9.6	0	
2-JMS110.30	8/2/1984	S	1	25.2	8.5	9.1		
2-JMS110.30	8/15/1984	S	1	25	7.4	8.8		
2-JMS110.30	8/27/1984	S	0.3	25.5	8.5			
2-JMS110.30	8/29/1984	S	1	25.1	8.5	9.1		
2-JMS110.30	9/12/1984	S	1	24	8.2	8.2		
2-JMS110.30	9/25/1984	S	1	24	7.6	9.1		
2-JMS110.30	10/11/1984	S	1	18.5	8.2	9.8	0	
2-JMS110.30	10/18/1984	S	1	19.5		9.5		
2-JMS110.30	10/22/1984	S	0.3	22	6.4			8.8
2-JMS110.30	11/2/1984	S	1	19	8.1	9.5	0	
2-JMS110.30	11/16/1984	S	1		7.6	10.4		
2-JMS110.30	12/12/1984	S	1	4	6.5	13.7	0	
2-JMS110.30	1/29/1985	S	0.3	1.2	7.4			14.2
2-JMS110.30	2/4/1985	S	1	0	6.7	13.8	0	
2-JMS110.30	2/27/1985	S	0.3	12.5	7.1			10.8
2-JMS110.30	3/11/1985	S	1	9	7.8	11.6	0	11.6
2-JMS110.30	3/11/1985	B	2	9		11.6	0	
2-JMS110.30	3/27/1985	S	1	13	8.7	11.1	0	10.4
2-JMS110.30	3/28/1985	S	0.3	16	8.7			11.1
2-JMS110.30	4/10/1985	B	1.5	14		11	0	
2-JMS110.30	4/10/1985	S	1	14	7.3	11	0	10.8
2-JMS110.30	4/22/1985	S	0.3	24.5	8.3			11
2-JMS110.30	4/24/1985	S	1	25	8.4	8.6	0	8.3
2-JMS110.30	5/8/1985	S	1	23	6.9	9	0	8.4
2-JMS110.30	5/22/1985	S	1	23.3	8.1	11.1	0	8.5
2-JMS110.30	5/29/1985	S	0.3	19.5	6.7			9.1
2-JMS110.30	6/19/1985	S	1	27	8.9	8.6	0	8.4
2-JMS110.30	7/2/1985	S	1	25	8.22	8.9	0	8
2-JMS110.30	7/17/1985	S	1	27.5		8.4	0	
2-JMS110.30	7/31/1985	S	0.3	28	8.2			8.4
2-JMS110.30	8/5/1985	S	1	27	8.3	8.4	0	
2-JMS110.30	8/15/1985	S	1	30.5	8.3	7.8	0	7.5
2-JMS110.30	8/20/1985	S	0.3	24.5	6.6			8.4
2-JMS110.30	9/4/1985	S	1	29	7.7	8.2	0	
2-JMS110.30	9/16/1985	S	0.3	22.5	8.4			10.1
2-JMS110.30	9/17/1985	S	1	23.1	8.2	9.8	0	
2-JMS110.30	10/2/1985	S	1	21	7	11.1	0	8.8
2-JMS110.30	10/9/1985	S	0.3	18	6.8			10.6
2-JMS110.30	10/16/1985	S	1	23	7.8	9.8	0.1	
2-JMS110.30	11/18/1985	S	1		7.91			
2-JMS110.30	11/18/1985	B	2	14.5		10	0	
2-JMS110.30	11/26/1985	S	0.3	12	7.2			10.8
2-JMS110.30	12/4/1985	S	1	9	7.86	10.6	0	10.6
2-JMS110.30	12/17/1985	S	0.3	7	6.5			11.8
2-JMS110.30	1/15/1986	S	1	2	7.3	14	0	13.8

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	1/22/1986	S	0.3	8	7.4			13
2-JMS110.30	2/12/1986	S	1	5	6.45	12.8	0	12
2-JMS110.30	2/18/1986	S	0.3	6	6.74			12.6
2-JMS110.30	3/12/1986	S	1	11	6.66	12	0	11.4
2-JMS110.30	3/18/1986	S	0.3	12	6.4			10.8
2-JMS110.30	3/26/1986	S	1	14	7.2	10.6	0	11.7
2-JMS110.30	4/10/1986	S	1	14.7	6.8	9	0	9.6
2-JMS110.30	4/16/1986	S	0.3	15	6.6			10.5
2-JMS110.30	4/28/1986	S	1	24	9.1	8.8	0	7.9
2-JMS110.30	5/8/1986	S	1	23	8.36	8.6	0	8.3
2-JMS110.30	5/19/1986	S	0.3	24.4	9			10
2-JMS110.30	5/27/1986	S	1	22	8.45	8.7	0	8
2-JMS110.30	6/9/1986	S	1	29	8.51	8.5	0	7.7
2-JMS110.30	6/19/1986	S	0.3	28	8.78			8.6
2-JMS110.30	6/24/1986	S	1	28.5	8.54	8.5	0	7.8
2-JMS110.30	7/8/1986	S	1	32	9.1	8.1	0	7.9
2-JMS110.30	7/22/1986	S	1	30	8.23	8.1	0	7.7
2-JMS110.30	7/30/1986	S	0.3	30.5	8.61			7.6
2-JMS110.30	8/6/1986	S	1	27.2	8.74	8.42		8.1
2-JMS110.30	8/20/1986	S	1	25	7.52	7.9	0	8.5
2-JMS110.30	8/25/1986	S	0.3	26.5	8.51			9
2-JMS110.30	9/9/1986	S	1		8.81			12.4
2-JMS110.30	9/23/1986	S	1	25.5	8.75	8.4	0	8.7
2-JMS110.30	9/25/1986	S	0.3	25	8.65			8.6
2-JMS110.30	10/7/1986	S	1	21	8.82	9.4	0.1	9.1
2-JMS110.30	10/20/1986	S	0.3	14	8.6			11.8
2-JMS110.30	10/28/1986	S	1	14	8.6	10.2		10.6
2-JMS110.30	11/17/1986	S	0.3	9	8.2			11.4
2-JMS110.30	11/25/1986	S	1	9	7.9	14.5	0	11.5
2-JMS110.30	12/22/1986	S	1	6	7.34	11.8	0	12.6
2-JMS110.30	12/30/1986	S	0.3	6	7.38			11.6
2-JMS110.30	1/5/1987	S	1	4	8.85	12.6	0	12.7
2-JMS110.30	2/2/1987	S	0.3	2.5	8.1			12.1
2-JMS110.30	3/4/1987	B	3	7		12		
2-JMS110.30	3/4/1987	S	1	7	6.13	12	0	12.3
2-JMS110.30	3/5/1987	S	0.3	7	7.67			11.5
2-JMS110.30	3/18/1987	S	1	10	6.54	11.6	0	11
2-JMS110.30	3/31/1987	S	0.3	15	8.08			10.9
2-JMS110.30	4/8/1987	S	1	11	8.08	11.8	0	10.6
2-JMS110.30	4/14/1987	S	1	13.5	8.89	10.5	0	9.9
2-JMS110.30	5/6/1987	S	1		8.71			
2-JMS110.30	5/6/1987	S	0.3	17	8.19			9.8
2-JMS110.30	5/18/1987	S	1	25.4	8.95	8.1	0	8.2
2-JMS110.30	6/1/1987	S	1	29	8.73	8.6	0	7.8
2-JMS110.30	6/9/1987	S	0.3	28.2	8.11			4.38
2-JMS110.30	6/15/1987	S	1	27.2	8.21	8.53	0	8.3
2-JMS110.30	6/29/1987	S	1	29.2	8.55	7.8	0	9
2-JMS110.30	7/8/1987	S	0.3	31	8.83			7.9
2-JMS110.30	7/13/1987	S	1	31	8.72	8.4	0.1	8.2
2-JMS110.30	8/11/1987	S	1	29.5	8.69	7.6		7.9
2-JMS110.30	8/12/1987	S	0.3	28	8.41			9.8
2-JMS110.30	8/25/1987	S	1	25	8.39	8.2	0	7.8
2-JMS110.30	9/9/1987	S	1	23	7.17	8.3	0	
2-JMS110.30	9/21/1987	S	0.3	24	8.24			9
2-JMS110.30	10/8/1987	S	1	16.6	8.81	11	0	10.9
2-JMS110.30	10/26/1987	S	0.3	14	8.28			10.8

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	10/27/1987	S	1	11	7.01	10.6	0	10.1
2-JMS110.30	11/9/1987	S	1	15.5	8.4	10.4		10.2
2-JMS110.30	11/24/1987	S	0.3	7	8.32			13.4
2-JMS110.30	12/14/1987	S	0.3	7	8.2			
2-JMS110.30	1/20/1988	S	0.3	2	6.79			14.2
2-JMS110.30	2/17/1988	S	0.3	6.5	8.07			12.7
2-JMS110.30	3/16/1988	S	0.3	9.8	8.8			12.2
2-JMS110.30	4/28/1988	S	0.3	18	7.06			9.7
2-JMS110.30	5/23/1988	S	0.3	23	9.18			8.7
2-JMS110.30	5/23/1988	B	1	23	9.18			8.7
2-JMS110.30	6/13/1988	S	0.3	23	8.42			9.5
2-JMS110.30	6/29/1988	S	1	26	7.61	7.9	0	
2-JMS110.30	7/18/1988	S	1	32	8.22	7.7	0	
2-JMS110.30	7/25/1988	S	0.3	29	8.44			7.8
2-JMS110.30	8/1/1988	S	1	30.5	8.66	7.6	0	
2-JMS110.30	8/15/1988	S	1	30	8.29	8	0	
2-JMS110.30	8/29/1988	S	0.3	27.7	8.67			8.2
2-JMS110.30	9/12/1988	S	1	21.8	8.35	9.8	0	
2-JMS110.30	9/21/1988	S	0.3	25	8.69			9.3
2-JMS110.30	9/27/1988	S	1	19.1	8.58	9.7	0	
2-JMS110.30	10/11/1988	S	1	13.6	8.8	12	0	
2-JMS110.30	10/24/1988	S	0.3	10.3	8.29			11
2-JMS110.30	10/26/1988	S	1	9.2	8.62	12.3	0	
2-JMS110.30	11/14/1988	S	1	12.4	8.05	11.65	0	
2-JMS110.30	11/29/1988	S	0.3	5.9	8.12			13.5
2-JMS110.30	12/20/1988	S	1	3	7.25	16.5	0	
2-JMS110.30	12/20/1988	B	2	3		16	0	
2-JMS110.30	1/11/1989	S	1	6.1	7.11	14.4	0	
2-JMS110.30	1/30/1989	S	0.3	8.3	7.6			14
2-JMS110.30	2/8/1989	S	1	6.5	9.03	13.5		
2-JMS110.30	3/15/1989	S	1	9.8	8.23	13.6	0	
2-JMS110.30	3/21/1989	S	0.3	10.8	7.53			12.4
2-JMS110.30	3/28/1989	S	1	16.5	7.92	10.7	0	
2-JMS110.30	4/13/1989	S	1	13.9	8.05	11.3	0	
2-JMS110.30	4/19/1989	S	0.3	17	7.73			9.5
2-JMS110.30	5/24/1989	S	0.3	21.4	8.24			9.1
2-JMS110.30	6/26/1989	S	0.3	27.4	8.25			7.8
2-JMS110.30	7/25/1989	S	0.3	28	8.15			8
2-JMS110.30	8/16/1989	S	0.3	25.2	8.38			8.7
2-JMS110.30	9/27/1989	S	0.3	15.4	8.05			10.3
2-JMS110.30	10/18/1989	S	0.3	19.2	6.76			9.8
2-JMS110.30	11/20/1989	S	0.3	9.4	8.35			12.8
2-JMS110.30	12/19/1989	S	0.3	1	8.16			16.3
2-JMS110.30	1/25/1990	S	0.3	8.2	7.97			12.9
2-JMS110.30	2/13/1990	S	1	9.1	7.64	12.2	0	
2-JMS110.30	3/13/1990	S	1	13.6	7.95	10.6	0	
2-JMS110.30	3/28/1990	S	1	11.3	8.41	11.6	0	
2-JMS110.30	4/10/1990	S	1	11.4	8.51	11.7	0	
2-JMS110.30	4/25/1990	S	1	17.1	8.38	9.5	0	
2-JMS110.30	4/30/1990	S	0.3	20.3	8.25			9.4
2-JMS110.30	5/9/1990	S	1	20.2	7.38	9.4	0	
2-JMS110.30	5/21/1990	S	0.3	23.3	7.96			
2-JMS110.30	5/31/1990	S	1	15.9	6.08	10	0	
2-JMS110.30	6/14/1990	S	1	21.9	8.04	8.46	0	
2-JMS110.30	6/20/1990	S	0.3	24	8.53			8.3
2-JMS110.30	6/27/1990	S	1	24.5	8.55	7.92	0	

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	7/10/1990	S	1	28.66	6.99	7.82	0	
2-JMS110.30	7/10/1990	S	0.3	28.7	6.99			7.8
2-JMS110.30	7/24/1990	S	0.3	27.9	7.8			7.5
2-JMS110.30	7/24/1990	S	1	27.9	7.8	7.5	0	
2-JMS110.30	8/7/1990	S	1	25.5	8.08	7.33	0	
2-JMS110.30	8/7/1990	S	0.3	25.5	8.08			7.3
2-JMS110.30	8/23/1990	S	1	27	8.76	8.7	0	
2-JMS110.30	9/6/1990	S	1	27	8.58	9.4	0	
2-JMS110.30	9/6/1990	B	1	27	8.6			9.4
2-JMS110.30	9/24/1990	S	1	18.95	7.61	10.19	0	
2-JMS110.30	10/9/1990	S	0.3	24.1	7.88			8.4
2-JMS110.30	10/9/1990	S	1	24.13	7.88	8.44	0	
2-JMS110.30	10/25/1990	S	1	15.67	7.33	9.64	0	
2-JMS110.30	11/7/1990	S	0.3	13.3	7.46			10.8
2-JMS110.30	11/7/1990	S	1	13.31	7.46	10.83	0	
2-JMS110.30	12/12/1990	B	1	8.7	7.72	12.72	0	
2-JMS110.30	12/12/1990	S	0.3	8.7	7.7			12.7
2-JMS110.30	1/14/1991	S	1	6.48	7.23	12.35	0	
2-JMS110.30	1/14/1991	S	0.3	6.5	7.23			12.3
2-JMS110.30	2/25/1991	S	1	8.2	7.54	11.89	0	
2-JMS110.30	2/25/1991	S	0.3	8.2	7.54			11.9
2-JMS110.30	3/6/1991	S	1	10.18	7.29	11.31	0	
2-JMS110.30	3/20/1991	S	1	10.97	7.23	11.15	0	
2-JMS110.30	4/3/1991	S	0.3	11.2	7.3			11.65
2-JMS110.30	4/23/1991	S	1	16.6	7.17	10.54	0	
2-JMS110.30	5/2/1991	S	1	21.58	8.04	9.54	0	
2-JMS110.30	5/2/1991	S	0.3	21.6	8.04			9.5
2-JMS110.30	5/16/1991	S	1	27.65	8.31	7.83	0	
2-JMS110.30	6/13/1991	S	1	26.61	8.4	8.86	0	
2-JMS110.30	6/27/1991	S	1	24.52	7.39	8.16	0	
2-JMS110.30	7/16/1991	S	1	26.77	7.37	7.96	0	
2-JMS110.30	7/16/1991	S	0.3					
2-JMS110.30	7/30/1991	S	1	24.24	7.17	8.02	0	
2-JMS110.30	8/13/1991	S	1	26.98	7.31	8.27	0	
2-JMS110.30	8/27/1991	S	1	26.02	7.68	7.76	0	
2-JMS110.30	9/12/1991	S	0.3	27.4	8.03			8.5
2-JMS110.30	9/12/1991	B	1	27.41	8.03	8.51	0	
2-JMS110.30	10/1/1991	S	1	22.26	8.59	9.76	0	
2-JMS110.30	10/10/1991	B	1	19.71	8.12	10.2	0	
2-JMS110.30	10/10/1991	S	0.3	19.7	8.12			10.2
2-JMS110.30	10/28/1991	S	1	18.44	7.67	9.06	0	
2-JMS110.30	11/18/1991	S	1	9.27	7.4	10.99	0	
2-JMS110.30	12/11/1991	S	1	8.81	7.05	11.76	0	
2-JMS110.30	12/11/1991	S	0.3	8.8	7.05			11.8
2-JMS110.30	1/9/1992	S	0.3	7.3	6.94			12.2
2-JMS110.30	1/9/1992	S	1	7.32	6.94	12.22	0	
2-JMS110.30	1/12/1992	S	0.3					
2-JMS110.30	2/10/1992	S	1	3.45	7	13.38	0	
2-JMS110.30	2/10/1992	S	0.3	4	7	13.4		
2-JMS110.30	3/10/1992	S	0.3	13.8	6.94			10.2
2-JMS110.30	3/24/1992	S	1	8.79	6.25	11.77	0	
2-JMS110.30	4/7/1992	S	1	10.37	7.02	11.05	0	
2-JMS110.30	4/7/1992	S	0.3	10.4	7.02			11
2-JMS110.30	4/21/1992	S	1	19.1	7.32	8.95	0	
2-JMS110.30	4/23/1992	S	0.3	19.1	6.6			8.9
2-JMS110.30	5/6/1992	S	0.3	17.3	7.17	9.4		

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	5/27/1992	S	1	18.6	7	9.6	0	
2-JMS110.30	6/4/1992	S	0.3	20.4	7.25			9.5
2-JMS110.30	6/18/1992	S	1	22.72	7.41	8.61	0	
2-JMS110.30	7/6/1992	S	1	26.5	7.33	7.53	0	
2-JMS110.30	7/6/1992	S	0.3	26.5	7.33	7.5		
2-JMS110.30	7/20/1992	S	1	28.26	7.54	7.47	0	
2-JMS110.30	8/18/1992	S	0.3	25.6	7.8	8.4		
2-JMS110.30	9/1/1992	S	1	24.96	7.82	7.71	0	
2-JMS110.30	9/15/1992	S	0.3	22.5	7.7	8.4		
2-JMS110.30	10/8/1992	S	1	16.25	7.72	9.7	0	
2-JMS110.30	11/2/1992	S	1	13.88	7.72	10.14	0	
2-JMS110.30	11/2/1992	S	0.3	13.9	7.6	10.1		
2-JMS110.30	11/17/1992	S	0.3	7.8	7.53	11.9		
2-JMS110.30	11/17/1992	S	1	7.76	7.53	11.93	0	
2-JMS110.30	12/15/1992	S	0.3	5.3	7.15	12.5		
2-JMS110.30	12/15/1992	S	1	5.35	7.15	12.55	0	
2-JMS110.30	1/12/1993	S	0.3	6.3	7.07	12.4		
2-JMS110.30	1/17/1993	S	0.3	15	8.04			10.3
2-JMS110.30	2/9/1993	S	0.3	4.5	7.65	13.1		
2-JMS110.30	2/9/1993	S	1	4.51	7.65	13.08	0	
2-JMS110.30	3/10/1993	S	1	8.34	7	11.35	0	
2-JMS110.30	3/10/1993	S	0.3	8.4	7	11.3		
2-JMS110.30	4/8/1993	S	0.3	12		10.8		
2-JMS110.30	4/8/1993	S	1	11.98	7.22	10.8	0	
2-JMS110.30	4/28/1993	S	1	17.72	7.07	9.48	0	
2-JMS110.30	5/6/1993	S	1	22.32	8.19	9.23	0	
2-JMS110.30	6/2/1993	S	1	23.41	7.84	8.73	0	
2-JMS110.30	6/7/1993	S	1	25.09	7.55	8.53	0	
2-JMS110.30	6/7/1993	S	0.3	25.1	7.55			8.5
2-JMS110.30	6/22/1993	S	1	29.6	8.43	8.22	0	
2-JMS110.30	7/7/1993	S	0.3	29.3	7.36			7.3
2-JMS110.30	7/7/1993	S	1	29.28	7.36	7.28	0	
2-JMS110.30	7/21/1993	S	1	28.46	7.34	7.54	0	
2-JMS110.30	8/4/1993	S	1	27.25	7.41	7.8	0	
2-JMS110.30	8/18/1993	S	1	28.46	7.96	8.71	0	
2-JMS110.30	9/2/1993	S	0.3	31.3	8.61			
2-JMS110.30	9/2/1993	S	1	31.33	8.61	8.13	0	
2-JMS110.30	9/20/1993	S	1	22.27	8.23	8.23	0	
2-JMS110.30	10/5/1993	S	1	20.98	9.29	9.57	0	
2-JMS110.30	12/2/1993	S	1	8.38	6.92	12.25	0	
2-JMS110.30	12/27/1993	S	0.3	2.7	7.72			14.2
2-JMS110.30	1/12/1994	S	0.3	2.4	7.29			13.7
2-JMS110.30	1/26/1994	S	1	2.11	7.58	13.76		
2-JMS110.30	2/1/1994	S	0.3	4.3	7.23			13.9
2-JMS110.30	2/17/1994	S	1	4.79	7.22	13.24	0	
2-JMS110.30	3/21/1994	S	1	10.12	7.56	11.38	0	
2-JMS110.30	4/14/1994	S	1	17.94	8.25	9.85	0	
2-JMS110.30	5/23/1994	S	1	23.11	9.15	9.42	0	
2-JMS110.30	6/9/1994	S	1	27.06	8.81	8.39	0	
2-JMS110.30	6/27/1994	S	0.3	27.9	8.03	8.1		
2-JMS110.30	7/7/1994	S	1	32.77	8.76	8.89	0	
2-JMS110.30	7/13/1994	S	0.3	30.55	8.18	6.88		
2-JMS110.30	7/14/1994	S	0.3	30.69	8.49	8.37		
2-JMS110.30	7/28/1994	S	0.3	27.97	7.99	7.87		
2-JMS110.30	8/11/1994	S	1	29.75	8.7	8.34	0	
2-JMS110.30	8/17/1994	S	0.3	25.89	7.89	8.21		

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	8/30/1994	S	0.3	27.68	8.69	8.5		
2-JMS110.30	9/8/1994	S	1	25.66	8.91	8.66	0	
2-JMS110.30	9/13/1994	S	0.3	25.17	8.76	9.77		
2-JMS110.30	9/22/1994	S	0.3	21.92	8.02	8.29		
2-JMS110.30	9/26/1994	S	0.3	22.33	8.05	8.89		
2-JMS110.30	10/12/1994	S	0.3	16.65	8.33	11.19		
2-JMS110.30	10/17/1994	S	1	16.62	8.57	11.34		
2-JMS110.30	10/25/1994	S	0.3	16.92	8.15	10.71		
2-JMS110.30	11/30/1994	S	1	9.43	8.17	11.82	0	
2-JMS110.30	12/6/1994	S	1	10.88	8.4	11.81	0	
2-JMS110.30	1/25/1995	S	1	5.98	7.58	12.93	0	
2-JMS110.30	2/22/1995	S	1	7.5	7.9	12.75	0	
2-JMS110.30	3/23/1995	S	1	14.41	8.33	10.44	0	
2-JMS110.30	4/18/1995	S	1	17.67	8.7	10.46		
2-JMS110.30	5/2/1995	S	0.3	16.4	7.69	9.65		
2-JMS110.30	5/18/1995	S	0.3	22.54	7.51	8.72		
2-JMS110.30	5/23/1995	S	1	25.57	8.52	8.95	0	
2-JMS110.30	6/1/1995	S	0.3	24.11	8.14	9.19		
2-JMS110.30	6/20/1995	S	1	27.04	8.41	8.78	0	
2-JMS110.30	7/18/1995	S	1	32.35	8.49	8.32	0	
2-JMS110.30	7/31/1995	S	0.3	30.7	8.19	8.31	0	
2-JMS110.30	8/14/1995	S	0.3	30.41	8.32	7.78		
2-JMS110.30	8/23/1995	S	1	29.11	7.55	8.25	0	
2-JMS110.30	8/28/1995	S	0.3	27.13	8.31	8.47		
2-JMS110.30	9/11/1995	S	0.3	24.98	8.59	9.74		
2-JMS110.30	9/20/1995	S	0.3	22.8	8.5	9.6		
2-JMS110.30	9/21/1995	S	1	23.28	8.37	9.24	0	
2-JMS110.30	10/5/1995	S	0.3	22.2	7.71	8.86		
2-JMS110.30	10/19/1995	S	1	18.38	8.58	9.38	0	
2-JMS110.30	10/24/1995	S	0.3	14.97	7.4	10.34		
2-JMS110.30	11/20/1995	S	1	7.6	7.85	12.43	0	
2-JMS110.30	12/14/1995	S	1	3.81	6.82	14.29	0	
2-JMS110.30	1/29/1996	S	1	4.49	7.06	14.71	0	
2-JMS110.30	2/20/1996	S	1	5.07	6.52	13.16	0	
2-JMS110.30	3/25/1996	S	1	9.63	7.71	11.89	0	
2-JMS110.30	4/30/1996	S	1	19.62	8.27	9.15	0	
2-JMS110.30	5/6/1996	S	0.3	21.71	8.63	9.79		
2-JMS110.30	5/15/1996	S	1	19.24	8.6	9.9	0	
2-JMS110.30	5/28/1996	S	0.3	18.57	7.71	9.7		
2-JMS110.30	6/3/1996	S	0.3	21.93	8.08	9.27		
2-JMS110.30	6/11/1996	S	0.3	26.42	7.75	8.11		
2-JMS110.30	6/18/1996	S	1	28.81	8.08	7.83	0	
2-JMS110.30	7/1/1996	S	0.3	27.57	7.88	8.18		
2-JMS110.30	7/15/1996	S	0.3	27.29	7.64	8.99		
2-JMS110.30	7/23/1996	S	1	28.15	7.14	7.42	0	
2-JMS110.30	8/1/1996	S	0.3	26.81	7.67	6.67		
2-JMS110.30	8/15/1996	S	0.3	24.98	7.64	8.28		
2-JMS110.30	8/20/1996	S	1	28.16	8.58	8.43	0	
2-JMS110.30	9/16/1996	S	0.3	21.84	7.71	9.23		
2-JMS110.30	9/24/1996	S	1	21.12	7.92	9.02	0	
2-JMS110.30	9/30/1996	S	0.3	21.17	8.63	11.3		
2-JMS110.30	10/9/1996	S	0.3	15.44	7.66	9.64		
2-JMS110.30	10/22/1996	S	1	14.9	8.42	10.63	0	
2-JMS110.30	10/30/1996	S	0.3	16.34	8.27	10.08		
2-JMS110.30	11/19/1996	S	1	6.77	7.79	12.28	0	
2-JMS110.30	12/10/1996	S	1	5.13	7.09	12.83	0	

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	1/21/1997	S	1	0.76	6.74	16	0	
2-JMS110.30	2/18/1997	S	1	6.42	7.61	12.75	0	
2-JMS110.30	3/18/1997	S	1	10.38	7.84	11.33	0	
2-JMS110.30	4/22/1997	S	1	13.81	8.37	10.63	0	
2-JMS110.30	5/21/1997	S	0.3	22.2	8.2	10.57		
2-JMS110.30	5/27/1997	S	0.3	21.86	8.11	9.2		
2-JMS110.30	5/28/1997	S	1	22.32	8.63	9.33	0	
2-JMS110.30	6/3/1997	S	0.3	21.21	7.61	9.14		
2-JMS110.30	6/23/1997	S	0.3	28.3	7.95	8.16		
2-JMS110.30	6/24/1997	S	1	30.75	8.91	8.49	0	
2-JMS110.30	7/9/1997	S	0.3	29.94	8.8	8.47		
2-JMS110.30	8/7/1997	S	0.3	27.79	8.71	8.69		
2-JMS110.30	8/19/1997	S	1	29.19	8.52	8.23	0	
2-JMS110.30	8/21/1997	S	0.3	27.75	8.44	9.36		
2-JMS110.30	9/4/1997	S	0.3	22.55	8.34	8.67		
2-JMS110.30	9/23/1997	S	1	24.07	8.97	9.99	0	
2-JMS110.30	10/2/1997	S	0.3	19.62	8.77	9.93		
2-JMS110.30	10/20/1997	S	0.3	15.19	8.33	10.42		
2-JMS110.30	10/21/1997	S	1	15.43	8.36	10.45	0	
2-JMS110.30	11/18/1997	S	1	7.83	8	12.33		
2-JMS110.30	12/10/1997	S	1	5.46	7.73	11.82		
2-JMS110.30	1/21/1998	S	1	5.95	7.53	12.72		
2-JMS110.30	2/18/1998	S	1	7.9	7.14	11.91		
2-JMS110.30	3/17/1998	S	1	7.09	7.75	12.56		
2-JMS110.30	4/21/1998	S	1	14.7	7.37	10.04		
2-JMS110.30	5/18/1998	S	0.3	23.2	8.3	9.17		
2-JMS110.30	5/19/1998	S	1	25.07	8.54	8.81		
2-JMS110.30	5/26/1998	S	0.3	24.66	8.82	9.14		
2-JMS110.30	6/16/1998	S	0.3	26.13	8.71	8.75		
2-JMS110.30	6/23/1998	S	1	29.98	8.94	8.68		
2-JMS110.30	6/30/1998	S	0.3	29.51	8.63	8.3		
2-JMS110.30	7/14/1998	S	0.3	27.81	8.54	8.79		
2-JMS110.30	7/21/1998	S	1	32.26	8.93	7.99		
2-JMS110.30	7/28/1998	S	0.3	28.57	8.75	8.48		
2-JMS110.30	8/11/1998	S	0.3	29.37	8.29	8.07		
2-JMS110.30	8/18/1998	S	1	29.43	8.92	8.13		
2-JMS110.30	8/25/1998	S	0.3	28.87	8.44	7.96		
2-JMS110.30	9/14/1998	S	0.3	25.55	8.52	9.12		
2-JMS110.30	9/22/1998	S	1	28.08	8.76	8.93	0	
2-JMS110.30	9/29/1998	S	0.3	24.88	8.41	9.37		
2-JMS110.30	10/13/1998	S	0.3	19.44	8.19	9.58		
2-JMS110.30	10/20/1998	S	1	20.35	8.67	9.79		
2-JMS110.30	10/26/1998	S	0.3	15.97	8.46	10.85		
2-JMS110.30	11/18/1998	S	1	12.55	8.22	10.78		
2-JMS110.30	12/15/1998	S	1	8.45	7.91	13.14		
2-JMS110.30	1/19/1999	S	1	5.96	7.69	12.18		
2-JMS110.30	2/23/1999	S	1	5.86	8.22	13.66		
2-JMS110.30	3/23/1999	S	1	9.67	7.14	11.44		
2-JMS110.30	4/20/1999	S	1	17.41	8.92	10.19		
2-JMS110.30	5/11/1999	S	0.3	24.91	8.44	8.7		
2-JMS110.30	5/20/1999	S	1	21.64	8.17	8.91		
2-JMS110.30	5/25/1999	S	0.3	22.44	7.79	8.58		
2-JMS110.30	6/7/1999	S	0.3	28.08	8.88	9.68		
2-JMS110.30	6/21/1999	S	0.3	21.58	7.81	9.11		
2-JMS110.30	6/22/1999	S	1	23.63	8.54	9.9		
2-JMS110.30	7/12/1999	S	0.3	26.67	8.11	8.39		

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	7/20/1999	S	1	31.29		8.8		
2-JMS110.30	7/21/1999	S	0.3	29.74	8.46	9.08		
2-JMS110.30	8/10/1999	S	0.3	28.61	8.44	9.31		
2-JMS110.30	8/17/1999	S	1	31.08	9.01	9.43		
2-JMS110.30	8/31/1999	S	0.3	22.22	8.38	9.51		
2-JMS110.30	9/13/1999	S	0.3	24.38	8.12	8.85		
2-JMS110.30	9/21/1999	S	1	17.32	7.17	10.63	0	
2-JMS110.30	9/27/1999	S	0.3	22.38	8.13	9.57	0	
2-JMS110.30	10/13/1999	S	0.3	19.18	8.41	10.15	0	
2-JMS110.30	10/25/1999	S	0.3	13.73	8.74	12.73	0	
2-JMS110.30	10/28/1999	S	1	12.68	8.43	11.16	0	
2-JMS110.30	11/18/1999	S	1	10	7.8	11.1	0	
2-JMS110.30	12/21/1999	S	1	7.8	6.61	10.7	0	
2-JMS110.30	1/18/2000	S	1	2.99	6.36	15.33	0	
2-JMS110.30	2/23/2000	S	1	7.86	6.62	12.77	0	
2-JMS110.30	3/28/2000	S	1	14.54	7.37	10.68	0	
2-JMS110.30	4/24/2000	S	1	17.42	6.48	9.9	0	
2-JMS110.30	5/1/2000	S	0.3	17.93	8.14	9.98	0	
2-JMS110.30	5/22/2000	S	0.3	22.8	8.04	8.9	0	
2-JMS110.30	5/23/2000	S	1	23.08	7.54	8.81	0	
2-JMS110.30	6/5/2000	S	0.3	23.57	7.99	8.36	0	
2-JMS110.30	6/20/2000	S	1	27.22	7.22	8.5	0	
2-JMS110.30	6/22/2000	S	0.3	28.71	9.11	7.11	0	
2-JMS110.30	7/11/2000	S	0.3	29.69	8.59	7.74	0	
2-JMS110.30	7/18/2000	S	1	28.6	7.49	7.4	0	
2-JMS110.30	7/26/2000	S	0.3	24.13	7.82	8.33	0	
2-JMS110.30	8/7/2000	S	0.3	28.94	8.25	8.22	0	
2-JMS110.30	8/22/2000	S	1	25.89	7.45	7.1	0	
2-JMS110.30	8/22/2000	S	0.3	26.48	8.88	8.67	0	
2-JMS110.30	9/13/2000	S	0.3	26.38	8.58	8.06	0	
2-JMS110.30	9/26/2000	S	1	19.99	8.28	9.28	0.1	
2-JMS110.30	10/2/2000	S	0.3	20.54	8.69	11.35	0	
2-JMS110.30	10/16/2000	S	0.3	18.11	8.68	11.41	0	
2-JMS110.30	10/24/2000	S	1	18.28	8.39	9.69	0	
2-JMS110.30	10/30/2000	S	0.3	15.26	8.61	10.99	0	
2-JMS110.30	11/28/2000	S	1	6.25	7.59	13.69	0	
2-JMS110.30	1/23/2001	S	1	2.33	6.93	14	0	
2-JMS110.30	2/20/2001	S	1	8.61	7.8	12.89	0	
2-JMS110.30	3/27/2001	S	1	9.23	7.55	12.31	0	
2-JMS110.30	4/24/2001	S	1	19.02	8.19	9.64	0	
2-JMS110.30	5/7/2001	S	0.3	23.23	8.69	10.76		
2-JMS110.30	5/24/2001	S	1	21.02		8.9	0	
2-JMS110.30	5/30/2001	S	0.3	20.14	7.6	9.91		
2-JMS110.30	6/13/2001	S	0.3	28.95	8.47	9.73	0	
2-JMS110.30	6/19/2001	S	1	27.11	7.88	9.52	0	
2-JMS110.30	6/28/2001	S	0.3	29.25	8.55	9.25		
2-JMS110.30	7/5/2001	S	0.3	29.3	8.67	10.86		
2-JMS110.30	7/24/2001	S	1	27.79	7.85	7.35	0	
2-JMS110.30	7/30/2001	S	0.3	25.98	8.34	8.27		
2-JMS110.30	8/6/2001	S	0.3	29.94	8.7	8.93		
2-JMS110.30	8/21/2001	S	1	30.14	8.89	8.59	0	
2-JMS110.30	8/23/2001	S	0.3	29.03	8.79	8.93		
2-JMS110.30	9/18/2001	S	1	24.4	8.84	8.58	0.3	
2-JMS110.30	10/16/2001	S	1	19.92	8.49	10.13	0	
2-JMS110.30	11/27/2001	S	1	12.69	7.97	10.06	0	
2-JMS110.30	12/12/2001	S	1	10.76	7.69	11.22	0.2	

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	1/22/2002	S	1	4.34	7.94	13.44	0.1	
2-JMS110.30	2/19/2002	S	1	6.49	7.84	12.19	0.09	
2-JMS110.30	3/19/2002	S	1	12.19	7.68	12.34	0.13	
2-JMS110.30	4/16/2002	S	1	20.71	7.4	8.9	0.8	
2-JMS110.30	5/28/2002	S	1	24.54	7.43	7.41	0	
2-JMS110.30	6/25/2002	S	1	29.49	7.61	5.92	0	
2-JMS110.30	7/23/2002	S	1	29	7.65	6.73		
2-JMS110.30	8/13/2002	S	1	28.35	7.93	6.49	0	
2-JMS110.30	9/24/2002	S	1	22.46	8.33	7.68	0	
2-JMS110.30	10/22/2002	S	1	15.25	7.76	10.44	0	
2-JMS110.30	11/19/2002	S	1	9.83	7.13	12.35	0	
2-JMS110.30	12/10/2002	S	1	1.37	7.42	15.33	0	
2-JMS110.30	1/21/2003	S	1	0.47	7.31	18.31	0	
2-JMS110.30	2/25/2003	S	1	4.5	6.82	13.42	0	
2-JMS110.30	3/18/2003	S	1	11.38	7.61	10.72	0	
2-JMS110.30	4/15/2003	S	1	12.81	7.29	12.75	0	
2-JMS110.30	5/27/2003	S	1	17.01	7.22	10.22	0	
2-JMS110.30	6/24/2003	S	1	20.63	7.78	9.11	0	
2-JMS110.30	7/15/2003	S	1	26.41	7.57	8.47	0	
2-JMS110.30	8/26/2003	S	1	26.81	7.98	8.59	0	
2-JMS110.30	9/24/2003	S	1	20.36	7.12	9.02	0	
2-JMS110.30	10/28/2003	S	1	14.49	7.7	10.32	0	
2-JMS110.30	11/18/2003	S	1	11.49	7.2	10.3	0	
2-JMS110.30	12/16/2003	S	1	4.06	7.18	13.32	0	
2-JMS110.30	2/25/2004	S	1	6.1	7.51	13.41	0	
2-JMS110.30	3/23/2004	S	1	10.38	7.6	11.35	0	
2-JMS110.30	4/20/2004	S	1	17.15	7.26	10.15	0	
2-JMS110.30	5/18/2004	S	1		7.97			
2-JMS110.30	6/15/2004	S	1	24.33	7.82	7.98	0	
2-JMS110.30	8/17/2004	S	1	23.65	7.99	7.77	0	
2-JMS110.30	9/21/2004	S	1	20.91	7.9	8.95	0	
2-JMS110.30	10/19/2004	S	1	15.1	7.97	9.89	0	
2-JMS110.30	11/16/2004	S	1	9.31	7.75	11.7	0	
2-JMS110.30	12/14/2004	S	1	7.73	7.97	11.83	0	
2-JMS110.30	1/26/2005	S	1	0.99	7.38	14.57	0	
2-JMS110.30	2/15/2005	S	1	6.65	7.44	12.82	0	
2-JMS110.30	3/22/2005	S	1	10.95	7.61	11.35	0	
2-JMS110.30	4/19/2005	S	1	15.91	7.98	10.8	0	
2-JMS110.30	5/24/2005	S	1	20.12	8.8	7.78	0	
2-JMS110.30	6/21/2005	S	1	24.83	8.24	9.71	0	
2-JMS110.30	7/19/2005	S	1	29.65	7.94	7.41	0	
2-JMS110.30	8/23/2005	S	1	28.4	7.93	7.94	0	
2-JMS110.30	9/20/2005	S	1	26.5	7.93	7.66	0	
2-JMS110.30	10/18/2005	S	1	17.1	7.81	9.61	0	
2-JMS110.30	11/15/2005	S	1	13.8	7.44	11.61	0	
2-JMS110.30	12/13/2005	S	1	3.2	7.65	13.71	0	
2-JMS110.30	12/21/2005	S	1	3.2	7.65	13.71	0	
2-JMS110.30	1/17/2006	S	1	5.54	7.68	14.44	0	
2-JMS110.30	2/21/2006	S	1	5.64	7.7	12	0	
2-JMS110.30	3/20/2006	S	1	11.1	7.9	11.4		
2-JMS110.30	4/26/2006	S	1	19.9	7.7	8.9	0	
2-JMS110.30	5/15/2006	S	1	19	7.9	9.7	0	
2-JMS110.30	6/21/2006	S	0.3	30.8	8.9	8.3		
2-JMS110.30	6/29/2006	S	1	21.4	7	8.7	0	
2-JMS110.30	7/24/2006	S	1	28.5	8.1	7.8	0	
2-JMS110.30	8/22/2006	S	1	27.5	8.2	8.1	0	

Station ID	Collection Date	Depth	Depth	Temp Celcius	Field Ph	Do Probe	Salinity	Do Winkler
2-JMS110.30	9/26/2006	S	1	21.1	8.3	9.9	0	
2-JMS110.30	10/30/2006	S	1	11.5	7.4	12	0	
2-JMS110.30	11/15/2006	S	1	12.9	7.2	10.9	0	
2-JMS110.30	12/14/2006	S	1	6	7.7	13.3	0	
2-JMS110.30	1/24/2007	S	1	4.8	7.8	12.1	0	
2-JMS110.30	2/20/2007	S	1	3.5	7.6	14.7	0	
2-JMS110.30	3/19/2007	S	1	8.2	7.3	12.7	0	
2-JMS110.30	4/30/2007	S	1	20.4	8.6	9.9	0	
2-JMS110.30	5/30/2007	S	1	27.1	8.1	8.4	0	
2-JMS110.30	6/18/2007	S	1	25.7	8.5	9.6	0	
2-JMS110.30	7/23/2007	S	1	26.9	7.9	8.6		
2-JMS110.30	8/20/2007	S	1	26.6	7.2	6.9	0	
2-JMS110.30	9/24/2007	S	1	23.6	8.2	9.6	0	
2-JMS110.30	10/22/2007	S	1	20.1	8.3	9.9	0	
2-JMS110.30	11/13/2007	S	1	11.6	8.2	12.4	0	
2-JMS110.30	12/10/2007	S	1	7.8	7.6	12.8	0	
2-JMS110.30	1/23/2008	S	1	2.9	7.8	14.8	0	
2-JMS110.30	2/14/2008	S	1	5.6	7.9	12.8	0	
2-JMS110.30	3/18/2008	S	1	11.8	7.9	11.7	0	
2-JMS110.30	4/15/2008	S	1	16.1	8.1	10.6		
2-JMS110.30	5/22/2008	S	1	19.6	8.4	9.9	0	
2-JMS110.30	6/17/2008	S	1	28.9	8.3	8.2	0	
2-JMS110.30	7/15/2008	S	1	28.5	8.7	8.6	0	
2-JMS110.30	8/19/2008	S	1	28	8.3	7.8	0	
2-JMS110.30	9/16/2008	S	1	24.6	8	8.4	0	
2-JMS110.30	10/23/2008	S	1	13.4	8.2	11.1	0	
2-JMS110.30	11/24/2008	S	1	5.5	7.9	13.6	0	
2-JMS110.30	12/9/2008	S	1	4.1	7.9	15.6	0	
2-JMS110.30	1/21/2009	S	1	0.6	7.2	15.8	0	
2-JMS110.30	2/19/2009	S	1	7	7.6	12	0	
2-JMS110.30	3/17/2009	S	1	8.8	7.6	12.1	0	
2-JMS110.30	4/30/2009	S	1	20.1	7.9	9.5		
2-JMS110.30	5/19/2009	S	1	18.5	7.6	9.7		
2-JMS110.30	6/16/2009	S	1	25.5	8	8.5		
2-JMS110.30	7/21/2009	S	1	26.8	8.3	8.6		
2-JMS110.30	8/18/2009	S	1	29.4	8.4	8.1		
2-JMS110.30	9/15/2009	S	1	24.7	8.4	9.5		
90th Percentile				**28.6**	**8.7**			
10th Percentile				**5.6**	**7.1**			

					00900 HARDNESS, TOTAL (MG/L AS CACO3)	
Sta Id	Collection Date Time	Depth Desc	Depth	Container Id Desc	Value	Com Code
2-JMS110.30	10/20/1986 14:10	S	0.3	R	88	
2-JMS110.30	11/29/1988 10:30	S	0.3	R	80	
2-JMS110.30	02/21/1989 15:00	S	0.3	R	46	
2-JMS110.30	03/21/1989 10:50	S	0.3	R	48	
2-JMS110.30	04/19/1989 10:45	S	0.3	R	54	
2-JMS110.30	05/24/1989 10:25	S	0.3	R	64	
2-JMS110.30	06/26/1989 10:40	S	0.3	R	52	
2-JMS110.30	08/16/1989 10:50	S	0.3	R	58	
2-JMS110.30	09/27/1989 11:50	S	0.3	R	30	
2-JMS110.30	10/18/1989 10:30	S	0.3	R	62	
2-JMS110.30	11/20/1989 10:45	S	0.3	R	46	
2-JMS110.30	12/19/1989 11:40	S	0.3	R	60	
2-JMS110.30	01/25/1990 10:45	S	0.3	R	58	
2-JMS110.30	02/21/1990 10:10	S	0.3	R	56	
2-JMS110.30	03/22/1990 09:40	S	0.3	R	70	
2-JMS110.30	03/22/1990 10:30	S	0.3	R	58	
2-JMS110.30	04/30/1990 11:00	S	0.3	R	58	
2-JMS110.30	05/21/1990 15:50	S	0.3	R	186	
2-JMS110.30	06/20/1990 09:40	S	0.3	R	62	
2-JMS110.30	07/10/1990 09:10	B	1	R	72	
2-JMS110.30	07/24/1990 08:10	S	0.3	R	3600	
2-JMS110.30	08/07/1990 07:05	S	0.3	R	66	
2-JMS110.30	09/06/1990 11:00	B	1	R	102	
2-JMS110.30	10/09/1990 12:40	S	0.3	R	94	
2-JMS110.30	11/07/1990 08:50	S	0.3	R	68	
2-JMS110.30	12/12/1990 14:00	S	0.3	R	74	
2-JMS110.30	01/14/1991 08:35	S	0.3	R	96	
2-JMS110.30	02/25/1991 17:00	S	0.3	R	78	
2-JMS110.30	04/03/1991 09:05	S	0.3	R	58	
2-JMS110.30	05/02/1991 12:30	S	0.3	R	78	
2-JMS110.30	06/13/1991 11:51	S	0.3	R	64	
2-JMS110.30	07/16/1991 09:00	S	0.3	R	37	
2-JMS110.30	09/12/1991 13:00	S	0.3	R	92	
2-JMS110.30	10/10/1991 13:15	S	0.3	R	116	
2-JMS110.30	12/11/1991 08:55	S	0.3	R	48	
2-JMS110.30	01/09/1992 08:40	S	0.3	R	40	
2-JMS110.30	01/12/1992 17:30	S	0.3	R	41	
2-JMS110.30	02/10/1992 08:45	S	0.3	R	72	
2-JMS110.30	03/10/1992 11:55	S	0.3	R	46	
2-JMS110.30	04/07/1992 08:50	S	0.3	R	60	
2-JMS110.30	04/23/1992 15:30	S	0.3	R	66	
2-JMS110.30	05/06/1992 09:40	S	0.3	R	68	
2-JMS110.30	06/04/1992 08:50	S	0.3	R	66	
2-JMS110.30	07/06/1992 09:15	S	0.3	R	82	
2-JMS110.30	08/18/1992 12:45	S	0.3	R	70	
2-JMS110.30	09/15/1992 08:45	S	0.3	R	60	
2-JMS110.30	11/02/1992 08:40	S	0.3	R	89	
2-JMS110.30	11/17/1992 08:45	S	0.3	R	56	
2-JMS110.30	12/15/1992 08:30	S	0.3	R	29	
2-JMS110.30	01/12/1993 17:30	S	0.3	R	41	

					00900 HARDNESS, TOTAL (MG/L AS CACO3)	
Sta Id	Collection Date Time	Depth Desc	Depth	Container Id Desc	Value	Com Code
2-JMS110.30	02/09/1993 08:35	S	0.3	R	58	
2-JMS110.30	03/10/1993 12:10	S	0.3	R	50	
2-JMS110.30	04/08/1993 15:45	S	0.3	R	48	
2-JMS110.30	05/06/1993 14:45	S	0.3	R	50	
2-JMS110.30	09/02/1993 17:00	S	0.3	R	82	
2-JMS110.30	11/17/1993 15:55	S	0.3	R	90	
2-JMS110.30	12/27/1993 17:35	S	0.3	R	66	
2-JMS110.30	01/12/1994 18:00	S	0.3	R	74	
2-JMS110.30	01/26/1994 16:15	S	1	R	50	
2-JMS110.30	02/01/1994 17:25	S	0.3	R	38	
2-JMS110.30	02/17/1994 16:15	S	1	R	42	
2-JMS110.30	03/21/1994 16:20	S	1	R	50	
2-JMS110.30	04/14/1994 17:00	S	1	R	50	
2-JMS110.30	05/23/1994 16:55	S	1	R	52	
2-JMS110.30	06/09/1994 17:20	S	1	R	63	
2-JMS110.30	09/08/1994 17:01	S	1	R	66	
2-JMS110.30	10/17/1994 15:41	S	1	R	81	
2-JMS110.30	11/30/1994 15:44	S	1	R	69	
2-JMS110.30	12/06/1994 16:12	S	1	R	71	
2-JMS110.30	01/25/1995 15:38	S	1	R	49	
2-JMS110.30	02/22/1995 15:45	S	1	R	84	
2-JMS110.30	03/23/1995 15:57	S	1	R	54	
2-JMS110.30	04/18/1995 15:33	S	1	R	57	
2-JMS110.30	05/23/1995 15:22	S	1	R	30	
2-JMS110.30	06/20/1995 15:41	S	1	R	49	
2-JMS110.30	07/18/1995 15:41	S	1	R	62	
2-JMS110.30	08/23/1995 15:23	S	1	R	86	
2-JMS110.30	09/21/1995 15:14	S	1	R	103	
2-JMS110.30	10/19/1995 17:45	S	1	R	60	
2-JMS110.30	11/20/1995 15:17	S	1	R	52	
2-JMS110.30	12/14/1995 15:03	S	1	R	45	
2-JMS110.30	01/29/1996 15:03	S	1	R	28	
2-JMS110.30	02/20/1996 15:23	S	1	R	50	
2-JMS110.30	03/25/1996 15:33	S	1	R	66	
2-JMS110.30	04/30/1996 11:40	S	1	R	58	
2-JMS110.30	05/15/1996 15:10	S	1	R	50	
2-JMS110.30	06/18/1996 15:03	S	1	R	50	
2-JMS110.30	07/23/1996 16:01	S	1	R	60	
2-JMS110.30	08/20/1996 15:01	S	1	R	66	
2-JMS110.30	09/24/1996 15:45	S	1	R	60	
2-JMS110.30	10/22/1996 14:57	S	1	R	63	
2-JMS110.30	11/19/1996 14:34	S	1	R	59	
2-JMS110.30	12/10/1996 15:11	S	1	R	44	
2-JMS110.30	01/21/1997 15:31	S	1	R	58.2	
2-JMS110.30	02/18/1997 14:49	S	1	R	44.7	
2-JMS110.30	03/18/1997 15:21	S	1	R	53.8	
2-JMS110.30	04/22/1997 16:03	S	1	R	58.4	
2-JMS110.30	05/28/1997 15:19	S	1	R	55.2	
2-JMS110.30	06/24/1997 14:56	S	1	R	59.3	
2-JMS110.30	07/15/1997 14:41	S	1	R	77.8	

					00900 HARDNESS, TOTAL (MG/L AS CACO3)	
Sta Id	Collection Date Time	Depth Desc	Depth	Container Id Desc	Value	Com Code
2-JMS110.30	08/19/1997 15:56	S	1	R	72.2	
2-JMS110.30	09/23/1997 14:27	S	1	R	64	
2-JMS110.30	10/21/1997 15:04	S	1	R	58.1	
2-JMS110.30	11/18/1997 15:31	S	1	R	57.9	
2-JMS110.30	12/10/1997 15:03	S	1	R	74.8	
2-JMS110.30	01/21/1998 16:03	S	1	R	44.4	
2-JMS110.30	02/18/1998 15:54	S	1	R	39.8	
2-JMS110.30	03/17/1998 15:49	S	1	R	44.3	
2-JMS110.30	04/21/1998 16:00	S	1	R	32.3	
2-JMS110.30	05/19/1998 16:06	S	1	R	41.5	
2-JMS110.30	06/23/1998 16:01	S	1	R	59.4	
2-JMS110.30	07/21/1998 16:08	S	1	R	64.8	
2-JMS110.30	08/18/1998 15:17	S	1	R	57.5	
2-JMS110.30	09/22/1998 15:59	S	1	R	88.5	
2-JMS110.30	10/20/1998 15:44	S	1	R	102	
2-JMS110.30	11/18/1998 14:59	S	1	R	94	
2-JMS110.30	12/15/1998 15:44	S	1	R	77	
2-JMS110.30	01/19/1999 15:01	S	1	R	82	
2-JMS110.30	02/23/1999 15:41	S	1	R	52	
2-JMS110.30	03/23/1999 15:44	S	1	R	54	
2-JMS110.30	04/20/1999 15:29	S	1	R	70	
2-JMS110.30	05/20/1999 12:54	S	1	R	56	
2-JMS110.30	06/22/1999 15:01	S	1	R	65	
2-JMS110.30	07/20/1999 15:51	S	1	R	88.1	
2-JMS110.30	08/17/1999 15:19	S	1	R	90.5	
2-JMS110.30	09/21/1999 16:28	S	1	R	38	
2-JMS110.30	10/28/1999 12:51	S	1	R	69.9	
2-JMS110.30	11/18/1999 13:36	S	1	R	64.7	
2-JMS110.30	12/21/1999 14:30	S	1	R	39.8	
2-JMS110.30	01/18/2000 13:01	S	1	R	67.7	
2-JMS110.30	02/23/2000 12:00	S	1	R	54	
2-JMS110.30	03/28/2000 12:01	S	1	R	40	
2-JMS110.30	04/24/2000 13:13	S	1	R	39	
2-JMS110.30	05/23/2000 13:33	S	1	R	51	
2-JMS110.30	06/20/2000 12:33	S	1	R	59.2	
2-JMS110.30	07/18/2000 12:12	S	1	R	57	
2-JMS110.30	08/22/2000 12:31	S	1	R	63.7	
2-JMS110.30	09/26/2000 12:50	S	1	R	70	
2-JMS110.30	10/24/2000 15:11	S	1	R	77.2	
2-JMS110.30	11/28/2000 12:23	S	1	R	104	
2-JMS110.30	01/23/2001 10:01	S	1	R	64	
2-JMS110.30	02/20/2001 14:31	S	1	R	55	
2-JMS110.30	03/27/2001 09:12	S	1	R	33.5	
2-JMS110.30	04/24/2001 09:15	S	1	R	30.7	
2-JMS110.30	05/24/2001 09:00	S	1	R	94.5	
2-JMS110.30	06/19/2001 09:30	S	1	R	42.4	
2-JMS110.30	07/24/2001 09:45	S	1	R	74.9	
2-JMS110.30	08/21/2001 17:30	S	1	R	63.9	
2-JMS110.30	09/18/2001 18:00	S	1	R	78	
2-JMS110.30	10/16/2001 17:00	S	1	R	56.9	

					00900 HARDNESS, TOTAL (MG/L AS CACO3)	
Sta Id	Collection Date Time	Depth Desc	Depth	Container Id Desc	Value	Com Code
2-JMS110.30	11/27/2001 10:00	S	1	R	116	
2-JMS110.30	12/12/2001 09:45	S	1	R	103	
2-JMS110.30	01/22/2002 10:00	S	1	R	52.1	
2-JMS110.30	02/19/2002 09:33	S	1	R	46.2	
2-JMS110.30	03/19/2002 09:33	S	1	R	81.8	
2-JMS110.30	04/16/2002 07:30	S	1	R	52.2	
2-JMS110.30	05/28/2002 07:30	S	1	R	29.3	
2-JMS110.30	06/25/2002 07:15	S	1	R	91	
2-JMS110.30	07/23/2002 07:00	S	1	S1	208	
2-JMS110.30	08/13/2002 08:00	S	1	R	85	
2-JMS110.30	09/24/2002 08:00	S	1	R	27.2	
2-JMS110.30	10/22/2002 08:00	S	1	R	91.7	
2-JMS110.30	11/19/2002 08:00	S	1	R	34.4	
2-JMS110.30	12/10/2002 08:00	S	1	R	62.6	
2-JMS110.30	01/21/2003 09:50	S	1	R	63.6	
2-JMS110.30	02/25/2003 09:44	S	1	R	47.8	
2-JMS110.30	03/18/2003 09:01	S	1	R	55.4	
2-JMS110.30	04/15/2003 09:11	S	1	R	21.4	
2-JMS110.30	05/27/2003 09:44	S	1	R	39.3	
2-JMS110.30	06/24/2003 09:30	S	1	R	56.5	
2-JMS110.30	07/15/2003 09:49	S	1	R	47.8	
2-JMS110.30	08/26/2003 09:14	S	1	R	39.5	
2-JMS110.30	09/24/2003 09:19	S	1	R	27.9	
2-JMS110.30	10/28/2003 09:43	S	1	R	59.9	
2-JMS110.30	11/18/2003 09:11	S	1	R	42	
2-JMS110.30	12/16/2003 09:33	S	1	R	40	
2-JMS110.30	02/25/2004 09:34	S	1	R	68	
2-JMS110.30	03/23/2004 09:17	S	1	R	65.4	
2-JMS110.30	04/20/2004 09:15	S	1	R	45.7	
2-JMS110.30	05/18/2004 09:17	S	1	R	52	
2-JMS110.30	06/15/2004 09:30	S	1	R	49	
2-JMS110.30	07/20/2004 09:00	S	1	S1	138.2	
2-JMS110.30	08/17/2004 10:04	S	1	R	48.5	
2-JMS110.30	09/21/2004 12:48	S	1	R	78.6	
2-JMS110.30	10/19/2004 09:20	S	1	R	32	
2-JMS110.30	11/16/2004 10:22	S	1	R	49	
2-JMS110.30	12/14/2004 09:21	S	1	R	56	
2-JMS110.30	01/26/2005 11:33	S	1	R	56	
2-JMS110.30	02/15/2005 09:11	S	1	R	66	
2-JMS110.30	03/22/2005 09:33	S	1	R	56	
2-JMS110.30	04/19/2005 09:22	S	1	R	57.5	
2-JMS110.30	05/24/2005 09:54	S	1	R	50	
2-JMS110.30	06/21/2005 09:41	S	1	R	66	
2-JMS110.30	07/19/2005 09:15	S	1	R	60	
2-JMS110.30	08/23/2005 10:07	S	1	R	74	
2-JMS110.30	09/20/2005 09:52	S	1	R	94	
2-JMS110.30	10/18/2005 10:11	S	1	R	56	
2-JMS110.30	11/15/2005 09:26	S	1	R	82	
2-JMS110.30	12/13/2005 09:33	S	1	R	51	
2-JMS110.30	01/17/2006 09:33	S	1	R	74	

					00900 HARDNESS, TOTAL (MG/L AS CACO3)	
Sta Id	Collection Date Time	Depth Desc	Depth	Container Id Desc	Value	Com Code
2-JMS110.30	02/21/2006 09:44	S	1	R	64	
2-JMS110.30	03/20/2006 09:41	S	1	R	62	
2-JMS110.30	04/26/2006 09:33	S	1	R	52	
2-JMS110.30	05/15/2006 09:22	S	1	R	50	
2-JMS110.30	06/29/2006 08:03	S	1	R	44	
2-JMS110.30	07/24/2006 09:44	S	1	S1	82	
2-JMS110.30	08/22/2006 09:30	S	1	R	90	
2-JMS110.30	09/26/2006 09:33	S	1	R	70	
2-JMS110.30	10/30/2006 09:44	S	1	R	52	
2-JMS110.30	11/15/2006 12:43	S	1	R	38	
2-JMS110.30	12/14/2006 12:33	S	1	R	62	
2-JMS110.30	01/24/2007 12:29	S	1	R	56	
Average					**79**	

Winter Season Ambient Temperatures (degrees Celsius)						
January	February	March	April	May	November	December
2.22	2.78	8.89	20.56	14.44	3.33	5.56
4.44	4.44	12.78	20	20	5.56	4.44
5		11.67	14.44	13.33	6.11	8.89
6.67	1.11	11.11	14.44	21.11	11.67	13.33
11.11	3.33	7.22	12.22	18.89	6.67	10
10	6.67	13.33	14.44	21.11	12.22	6.11
5.56	6.67	14.44	14.44	20	7.22	10.5
4.44	2.5	11	13.89	2.1	0	7.5
3	3	17	14.44	3	17	5
4.5	8	6	13	17.5	17	12
6	7.5	10.5	16	20	14	4
0.5	10.5	6	9	26	15	4
1	0	12	13.5	20.5	13	9
1.2	12.5	10	15	28	10	7
2	5	11	17.5	23.5	19	6
8	6	9	12.5	23		6
4	2.5	9	14	23.3		7
2	6.5	13	14	19.5	14.5	3
6.1	6.5	16	24.5	23	12	3
8.3	9.1	11	25	24.4	9	1
8.2	8.2	12	14.7	22	9	8.7
6.48	8.2	14	15		15.5	8.7
6.5	3.45	7	24	17	7	8.81
7.3	4	7	11	25.4	12.4	8.8
7.32	4.5	7	13.5	23	5.9	5.3
	4.51	10	18	23	9.4	5.35
6.3	4.3	15	13.9	21.4	13.3	8.38
15	4.79	9.8	17	20.2	13.31	2.7
2.4	7.5	9.8	11.4	23.3	9.27	10.88
2.11	5.07	10.8	17.1	15.9	13.88	3.81
5.98	6.42	16.5	20.3	21.58	13.9	5.13
4.49	7.9	13.6	11.2	21.6	7.8	5.46
0.76	5.86	11.3	16.6	27.65	7.76	8.45
5.95	7.86	10.18	10.37	17.3	9.43	7.8
5.96	8.61	10.97	10.4	18.6	7.6	10.76
2.99	6.49	13.8	19.1	22.32	6.77	1.37
2.33	4.5	8.79	19.1	23.11	7.83	4.06
4.34	6.1	8.34	12	16.4	12.55	7.73
0.47	6.65	8.4	11.98	22.54	10	3.2
0.99	5.64	10.12	17.72	25.57	6.25	3.2
5.54	3.5	14.41	17.94	21.71	12.69	6
4.8	5.6	9.63	17.67	19.24	9.83	7.8
2.9	7	10.38	19.62	18.57	11.49	4.1
0.6		7.09	13.81	22.2	9.31	
		9.67	14.7	21.86	13.8	
		14.54	17.41	22.32	12.9	
		9.23	17.42	23.2	11.6	
		12.19	19.02	25.07	5.5	
		11.38	20.71	24.66		
		10.38	12.81	24.91		
		10.95	17.15	21.64		
		11.1	15.91	22.44		
		8.2	19.9	17.93		
		11.8	20.4	22.8		
		8.8	16.1	23.08		
			20.1	23.23		
				21.02		
				20.14		
				24.54		
				17.01		
				20.12		
				19		
				27.1		
				19.6		
				18.5		

90th %tile \	22.51

2010 Fact Sheets for 303(d) Waters

RIVER BASIN: James River Basin

HYDROLOGIC UNIT: 02080206

STREAM NAME: **James River**

TMDL ID: **G01E-01-BAC**

2010 IMPAIRED AREA ID: CB-JMSTFU

ASSESSMENT CATEGORY: 5A

TMDL DUE DATE: 2010

IMPAIRED SIZE: 6.2581 - Sq. Mi.

Watershed: VAP-G01E

INITIAL LISTING: 1996

UPSTREAM LIMIT: Fall Line (Mayos Bridge)

DOWNSTREAM LIMIT: Appomattox River

Estuarine James River from the fall line at Mayos Bridge downstream to the Appomattox River.

CLEAN WATER ACT GOAL AND USE SUPPORT:

Recreation Use - Not Supporting

IMPAIRMENT: E.coli

The James River from the fall line to the Appomattox River has been assessed as not supporting of the Recreation use support goal based on the results of a summer special study in the fall zone. The special study was designed to monitor the effects of summertime rain and combined sewer overflow (CSO) events on water quality in the James River and to monitor the effects of Richmond's CSO abatement efforts.

The segment has been included on the Impaired Waters list for fecal coliform since 1996. During the 2004 and 2006 cycles, the bacteria standard changed to E.coli for those stations with enough data. Some of the areas in this segment had converted to the E.coli standard, for others the fecal coliform standard was still in effect. During the 2008 cycle, the impairment was converted solely to E. coli. The TMDL for bacteria is due in 2010.

Bacteria impairment is noted at the following stations during the 2010 cycle:
2-JMS110.30
2-JMS104.16
2-JMS099.30

Although station 2-JMS087.01 is currently passing (5/50), the downstream extent will remain the same for this cycle due to the historical impairment and the marginal passing rate.

Farrar Gut was mistakenly combined with the mainstem in previous assessments. The stream is a separate waterbody and should not be included in the bacterial impairment, which only included the "estuarine James River".

IMPAIRMENT SOURCE: NPS - Urban, CSO

The source of the impairment in this section of the river is believed to be urban runoff from the tributary drainage basin and from combined sewer overflow events from the City of Richmond's combined sewer system.

The City is currently undertaking CSO abatement efforts. It is recommended that the ongoing CSO special study be continued to gauge the effects of CSO abatement efforts on water quality in this segment.

RECOMMENDATION: Problem Characterization

2010 Fact Sheets for 303(d) Waters

RIVER BASIN: James River Basin

HYDROLOGIC UNIT: 02080206

STREAM NAME: **James River**

TMDL ID: **G01E-02-CHLA**

2010 IMPAIRED AREA ID: CB-JMSTFU

ASSESSMENT CATEGORY: 5A

TMDL DUE DATE: 2010

IMPAIRED SIZE: 5.5117 - Sq. Mi.

Watershed: VAP-G01E

INITIAL LISTING: 2008

UPSTREAM LIMIT: Fall Line (Mayos Bridge)

DOWNSTREAM LIMIT: Appomattox River

Mainstem James River from the fall line at Mayos Bridge downstream to the JMSTFu/JMSTFl boundary at the Appomattox River.

CLEAN WATER ACT GOAL AND USE SUPPORT:

Aquatic Life Use - Not Supporting, Open Water Subuse - Not Supporting

IMPAIRMENT: Chlorophyll

The James River from the Appomattox River to the Chickahominy River was originally listed on the 1998 list as fully supporting but threatened of the Aquatic Life Use goal based on chlorophyll_a exceedances. During the 1998 cycle, EPA extended the segment upstream to the fall line and downgraded the river to not supporting the Aquatic Life Use, citing nutrient concerns.

In previous cycles, the mainstem James River had acceptable dissolved oxygen levels. In addition the entire tidal freshwater portion (fall line to just above the Chickahominy River) has good benthic community based on the results from the Chesapeake Bay Benthic Index of Biological Community; therefore the James River from the fall line to the oligohaline boundary was considered impaired solely for Nutrients/Eutrophication Biological Indicators (EPA Overlist).

A special site-specific chlorophyll standard for the mainstem James River was adopted during the 2008 cycle. The upper tidal freshwater segment exceeds both the spring and summer seasonal means.

Farrar Gut was mistakenly combined with the mainstem in previous assessments. The stream is a separate waterbody and should not be included in the chlorophyll a impairment, which only includes the mainstem James River.

IMPAIRMENT SOURCE: Point sources, Nonpoint Sources

The James River Tributary Strategy was developed to bring the river into attainment.

RECOMMENDATION: Problem Characterization

2010 Fact Sheets for 303(d) Waters

RIVER BASIN: James River Basin **HYDROLOGIC UNIT:** 02080206

STREAM NAME: **James River and Various Tributaries**

TMDL ID: **G01E-03-PCB** **2010 IMPAIRED AREA ID:** CB-JMSTFU

ASSESSMENT CATEGORY: 5A **TMDL DUE DATE:** 2014

IMPAIRED SIZE: ~325 - Stream mile **Watershed:** VAP-G01E

INITIAL LISTING: 2002

UPSTREAM LIMIT: Fall line

DOWNSTREAM LIMIT: Hampton Roads Bridge Tunnel

Estuarine James River from the fall line to the Hampton Roads Bridge Tunnel, including several tributaries listed below.

CLEAN WATER ACT GOAL AND USE SUPPORT:

Fish Consumption Use - Not Supporting

IMPAIRMENT: Fish Tissue - PCBs, VDH Fish Consumption Restriction

During the 2002 cycle, the James River from the Fall line to Queens Creek was considered not supporting of the Fish Consumption Use due to PCBs in multiple fish species at multiple DEQ monitoring locations.

During the 2004 cycle, a VDH Fish Consumption Restriction was issued from the fall line to Flowerdew Hundred and the segment was adjusted slightly to match the Restriction. In addition, in the 2004 cycle, the Chickahominy River from Walkers Dam to Diascund Creek was assessed as not supporting the Fish Consumption Use because the DEQ screening value for PCBs was exceeded in 3 species during sampling in 2001.

During the 2006 cycle, the VDH restriction was extended on 12/13/2004 to extend from the I-95 bridge downstream to the Hampton Roads Bridge Tunnel and include the tidal portions of the following tributaries:

Appomattox River up to Lake Chesdin Dam
Bailey Creek up to Route 630
Bailey Bay
Chickahominy River up to Walkers Dam
Skiffes Creek up to Skiffes Creek Dam
Pagan River and its tributary Jones Creek
Chuckatuck Creek
Nansemond River and its tributaries Bennett Creek and Star Creek
Hampton River
Willoughby Bay and the Elizabeth R. system (Western, Eastern, and Southern Branches and Lafayette R.) and tributaries St. Julian Creek, Deep Creek, and Broad Creek

The advisory was modified again on 10/10/2006 to add Poythress Run.

The impairments were combined. The TMDL for the lower extended portion is due in 2018.

Farrar Gut was mistakenly combined with the mainstem in previous assessments. The stream is a separate waterbody and is not included in the VDH Fish Consumption Advisory.

IMPAIRMENT SOURCE: Unknown

The source of the PCBs is considered unknown.

2010 Fact Sheets for 303(d) Waters

RIVER BASIN: James River Basin **HYDROLOGIC UNIT:** 02080206

STREAM NAME: **James River Tidal Freshwater (Upper) Estuary**

TMDL ID: **JMSTFU-DO-BAY** **2010 IMPAIRED AREA ID:** CB-JMSTFU

ASSESSMENT CATEGORY: 5A **TMDL DUE DATE:** 2010

IMPAIRED SIZE: 6.5749 - Sq. Mi. **Watershed:** VAP-G01E

INITIAL LISTING: 1998

UPSTREAM LIMIT: Fall line

DOWNSTREAM LIMIT: Tidal Freshwater/Oligohaline Boundary

The James River Tidal Freshwater Upper estuary, which extends from the fall line to approximately the Appomattox River, including tributaries.

CLEAN WATER ACT GOAL AND USE SUPPORT:

Aquatic Life Use - Not Supporting

IMPAIRMENT: Dissolved Oxygen

The mainstem James River from the Appomattox River to the Chickahominy River was originally listed on the 1998 list as fully supporting but threatened of the Aquatic Life Use goal based on chlorophyll_a exceedances. During the 1998 cycle, EPA extended the segment upstream to the fall line and downgraded the river to not supporting the Aquatic Life Use, citing nutrient concerns.

In previous cycles, the mainstem James River had acceptable dissolved oxygen levels. In addition the entire tidal freshwater portion (fall line to just above the Chickahominy River) has good benthic community based on the results from the Chesapeake Bay Benthic Index of Biological Community; therefore the James River from the fall line to the oligohaline boundary was considered impaired solely for Nutrients/Eutrophication Biological Indicators (EPA Overlist).

The CB water quality standards were implemented during the 2006 cycle. The 30-day dissolved oxygen criteria was met during the 2006 and 2008 cycles; however, during the 2010 cycle, the segment failed the summer 30-day Open Water dissolved oxygen criteria. The rest-of-year standard was met.

IMPAIRMENT SOURCE: Nonpoint Source, Point Source

The tributary strategy for the James River assigned sources and allocations.

RECOMMENDATION: Problem Characterization

2010 Fact Sheets for 303(d) Waters

RIVER BASIN: James River Basin **HYDROLOGIC UNIT:** 02080206

STREAM NAME: **James River Tidal Freshwater (Upper) Estuary**

TMDL ID: **JMSTFU-SAV-BAY** **2010 IMPAIRED AREA ID:** CB-JMSTFU

ASSESSMENT CATEGORY: 5A **TMDL DUE DATE:** 2010

IMPAIRED SIZE: 6.5998 - Sq. Mi. **Watershed:** VAP-G01E

INITIAL LISTING: 1998

UPSTREAM LIMIT: Fall line

DOWNSTREAM LIMIT: Tidal Freshwater/Oligohaline Boundary

The James River Tidal Freshwater Upper estuary, which extends from the fall line to approximately the Appomattox River, including tributaries.

CLEAN WATER ACT GOAL AND USE SUPPORT:

Aquatic Life Use - Not Supporting, Shallow Water Use - Not Supporting

IMPAIRMENT: Aquatic Macrophytes

The mainstem James River from the Appomattox River to the Chickahominy River was originally listed on the 1998 list as fully supporting but threatened of the Aquatic Life Use goal based on chlorophyll_a exceedances. During the 1998 cycle, EPA extended the segment upstream to the fall line and downgraded the river to not supporting the Aquatic Life Use, citing nutrient concerns.

In previous cycles, the mainstem James River had acceptable dissolved oxygen levels. In addition the entire tidal freshwater portion (fall line to just above the Chickahominy River) has good benthic community based on the results from the Chesapeake Bay Benthic Index of Biological Community; therefore the James River from the fall line to the oligohaline boundary was considered impaired solely for Nutrients/Eutrophication Biological Indicators (EPA Overlist).

During the 2006 cycle, the CB water quality standards were implemented. The Upper Tidal Freshwater James River from the fall line to the Appomattox fails the Shallow Water Use SAV criteria.

IMPAIRMENT SOURCE: Nonpoint Source, Point Source

The tributary strategy for the James River assigned sources and allocations.

RECOMMENDATION: Problem Characterization

Attachment D

Site Visit

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Wastewater Facility Inspection Report

Revised 08/2001

Facility Name:	Richmond WWTP	**Facility No.:**	VA0063177
City/~~County~~:	Richmond	**Inspection Agency:**	DEQ - PRO
Inspection Date:	August 11, 2009	**Date Form Completed:**	August 14, 2009
Inspector:	Charles Stitzer	**Time Spent:**	18 hrs. w/ travel & report
Reviewed By:		**Unannounced Insp.?**	No
		FY-Scheduled Insp.?	Yes

Present at Inspection: Clair Watson, Eric Whitehurst

TYPE OF FACILITY:

Domestic		Industrial	
[ ] Federal	[x] Major	[ ] Major	[ ] Primary
[x] Non-Federal	[ ] Minor	[ ] Minor	[ ] Secondary

Population Served: approx.: 215,000

Number of Connections: approx.: 58,000

TYPE OF INSPECTION:

[x] Routine — Date of last inspection: April 28, 2005

[ ] Compliance

[ ] Reinspection — Agency: DEQ/PRO

INFLUENT and EFFLUENT MONITORING: ***Please refer to the DMR File***

Last month average: **(Influent) Date:** Other: _____ mg/L	BOD: ___ mg/L	TSS: ____ mg/L	Flow: __ MGD
Last month: **(Effluent) Date:** Other:	CBOD: ____ mg/L	TSS: ____ mg/L	Flow:___ MGD
Quarter average: **(Effluent) Date:** Other:	CBOD: _____ mg/L	TSS: ____ mg/L	Flow: ___ MGD

CHANGES AND/OR CONSTRUCTION

DATA VERIFIED IN PREFACE	[ ] Updated	[x] No changes	
Has there been any new construction?	[ ] Yes*	[x] No	
If yes, were plans and specifications approved?	[ ] Yes	[ ] No*	[x] N/A
DEQ approval date:	N/A		

(A) PLANT OPERATION AND MAINTENANCE

1. Class and number of licensed operators: Class I – 16; Class II – 4; Class III – 9; Class IV – 0

2. Hours per day plant is staffed: *24 hours/day, 7 days/week*

3.	Describe adequacy of staffing:	[x] Good	[ ] Average	[ ] Poor*
4.	Does the plant have an established program for training personnel?	[x] Yes	[ ] No	
5.	Describe the adequacy of the training program:	[x] Good	[ ] Average	[ ] Poor*
6.	Are preventive maintenance tasks scheduled?	[x] Yes	[ ] No*	
7.	Describe the adequacy of maintenance:	[x] Good	[ ] Average	[ ] Poor*
8.	Does the plant experience any organic/hydraulic overloading?	[x] Yes*	[ ] No	

If yes, identify cause and impact on plant: The plant occasionally experiences high flows, however, I&I reduction required by an existing Consent Special Order and future plant construction should alleviate some of the peak flow problems.

9.	Any bypassing since last inspection?	[ ] Yes*	[x] No - *Not at the plant*	
10.	Is the on-site electric generator operational?	[ ] Yes	[ ] No*	[x] N/A
11.	Is the STP alarm system operational?	[x] Yes	[ ] No *	[ ] N/A
12.	How often is the standby generator exercised?	[ ] Weekly	[ ] Monthly	[x] Other: N/A
	Power Transfer Switch?	[ ] Weekly	[ ] Monthly	[x] Other:
	Alarm System?	[ ] Weekly	[x] Monthly	[ ]Other:

13. When were the cross connection control devices last tested on the potable water service? *See comment, below*

14. Is sludge disposed in accordance with the approved sludge disposal plan? [x] Yes [ ] No* [ ] N/A

15.	Is septage received by the facility?	[x] Yes	[ ] No	
	Is septage loading controlled?	[x] Yes	[ ] No *	[ ] N/A
	Are records maintained?	[x] Yes	[ ] No*	[ ] N/A
16.	Overall appearance of facility:	[x] Good	[ ] Average	[ ] Poor*

Comments: #1. The plant is fully staffed. #4. Training includes OJT, safety training, individualized training on new equipment and DEQ Certification Classes. The plant has an excellent incentive/reward program for upgrading certification. #6, 7 & 13. Annual RPZ certifications for the plant's 32 backflow preventers are scheduled and tracked by a computerized system. The tracking system indicates that the RPZ maintenance records are up-to-date. #9. Sanitary Sewer overflows are reported in accordance with the Permit. #11. Alarm signals report to operator's control/enunciator panel and MIS (management maintenance system). #12. Facility maintains two power feeds. #12a. The power transfer switch is activated several times throughout the year. #14. The approved plan calls for land application by contractor (Nutriblend). #15. Septage records are maintained by the Pretreatment Office at the WWTP.

(B) PLANT RECORDS

1. Which of the following records does the plant maintain?

Operational Logs for each unit process	[x] Yes	[ ] No*	[ ] N/A
Instrument maintenance and calibration	[x] Yes	[ ] No*	[ ] N/A
Mechanical equipment maintenance	[x] Yes	[ ] No*	[ ] N/A
Industrial waste contribution **(Municipal Facilities)**	[x] Yes	[ ] No*	[ ] N/A

2. What does the operational log contain?

Visual Observations	[x] Yes	[ ] No	[ ] N/A
Flow Measurement	[x] Yes	[ ] No	[ ] N/A
Laboratory Results	[x] Yes	[ ] No	[ ] N/A
Process Adjustments	[x] Yes	[ ] No*	[ ] N/A
Control Calculations	[x] Yes	[ ] No	[ ] N/A
Other:			

3. What do the mechanical equipment records contain:

As built plans and specs?	[x] Yes	[ ] No*	[ ] N/A
Spare parts inventory?	[x] Yes	[ ] No*	[ ] N/A
Manufacturer's instructions?	[x] Yes	[ ] No*	[ ] N/A
Equipment/parts suppliers?	[x] Yes	[ ] No*	[ ] N/A
Lubrication schedules?	[x] Yes	[ ] No*	[ ] N/A
Other:			

Comments: None

4. What do the industrial waste contribution records contain: *(Applicable to municipal facilities only)*

Waste characteristics?	[x] Yes	[ ] No*	[ ] N/A
Locations and discharge types?	[x] Yes	[ ] No*	[ ] N/A
Impact on plant?	[x] Yes	[ ] No*	[ ] N/A

Other: N/A

Comments: The pretreatment staff is responsible for managing the pretreatment permits, coordinating and conducting inspections and sampling, and maintaining septage records.

5. Are the following records maintained at the plant:

Equipment maintenance records	[x] Yes	[ ] No*	[ ] N/A
Operational Log	[x] Yes	[ ] No*	[ ] N/A
Industrial contributor records	[x] Yes	[ ] No*	[ ] N/A
Instrumentation records	[x] Yes	[ ] No*	[ ] N/A
Sampling and testing records	[x] Yes	[ ] No*	[ ] N/A

6. Are records maintained at a different location? [ ] Yes [x] No

Where are the records maintained? All are available on site.

7. Were the records reviewed during the inspection? [ ] Yes [x] No

8. Are the records adequate and the O & M Manual current? [x] Yes [ ] No* [ ] N/A

O&M Manual date written: 5th Supplement - July 1997

Date DEQ approved O&M: September 9, 1997 - VDH

9. Are the records maintained for required 3-year period? [x] Yes [ ] No*

Comments: #2 – In addition to operational logs where process control data is recorded, a log book is maintained at each manned station of the plant; the supervising operator signs in and makes staffing and operational notes. Lab records are maintained in the laboratory. #8 An extensive upgrade is ongoing which will require the current O&M Manual to be updated following the upgrade's completion.

(C) SAMPLING

1.	Are sampling locations capable of providing representative samples?	[x] Yes	[ ] No*	[ ] N/A
2.	Do sample types correspond to those required by the permit?	[x] Yes	[ ] No*	[ ] N/A
3.	Do sampling frequencies correspond to those required by the permit?	[x] Yes	[ ] No*	[ ] N/A
4.	Are composite samples collected in proportion to flow?	[x] Yes	[ ] No*	[ ] N/A
5.	Are composite samples refrigerated during collection?	[x] Yes	[ ] No*	[ ] N/A
6.	Does plant maintain required records of sampling?	[x] Yes	[ ] No*	[ ] N/A
7.	Does plant run operational control tests?	[x] Yes	[ ] No*	[ ] N/A

Comments:

(D) TESTING

1. Who performs the testing?
   [x] Plant/ Lab
   [ ] Central Lab
   [x] Commercial Lab: Microbac - Metals
   J.R. Reed & Assoc. – Bioassays

If plant performs any testing, complete 2-4.

2. What method is used for chlorine analysis? HACH Pocket Colorimeter
3. Is sufficient equipment available to perform required tests? [x] Yes [ ] No* [ ] N/A
4. Does testing equipment appear to be clean and/or operable? [x] Yes [ ] No* [ ] N/A

Comments: Please see DEQ Laboratory Inspection Report, conducted August 15, 2007.

(E) FOR INDUSTRIAL FACILITIES W/ TECHNOLOGY BASED LIMITS N/A

1. Is the production process as described in the permit application? (If no, describe changes in comments)
   [ ] Yes [ ] No* [x] N/A
2. Do products and production rates correspond to the permit application? (If no, list differences in comments section)
   [ ] Yes [ ] No* [x] N/A
3. Has the State been notified of the changes and their impact on plant effluent?
   [ ] Yes [ ] No* [x] N/A

Comments: None

FOLLOW UP TO COMPLIANCE RECOMMENDATIONS FROM THE AUGUST 15, 2007 DEQ INSPECTION:

There were no Compliance Recommendations from the August 15, 2007 DEQ inspection.

FOLLOW UP TO GENERAL RECOMMENDATIONS FROM THE AUGUST 15, 2007 DEQ INSPECTION:

There were no General Recommendations from the August 15, 2007 DEQ inspection.

INSPECTION REPORT SUMMARY

Compliance Recommendations/Request for Corrective Action:

There are no Compliance Recommendations at this time.

General Recommendations/Observations:

There are no General Recommendations at this time.

Comments:

The City of Richmond is working, under Consent Special Order dated March 17, 2005, to implement an ongoing plan to minimize combined sewer overflows ("CSO") during storm events, as well as minimize their impacts on the WWTP. The Consent Order addresses solids and floatables control at 6 CSO outfalls; sewer separation in 3 areas; in-line flow equalization, conveyance system upgrade at Lower Gillies Creek and modifications at the Shockoe Retention Basin. The Consent Order also requires upgrades at the WWTP to better handle wet weather flows, including expanded solids handling to provide reliable treatment up to 140 MGD; improved disinfection up to 300 MGD; and modifications to the final clarifiers to improve settling for up to 85 MGD. Annual Average CBOD and TSS concentrations for flows above 75 MGD are also identified in the Special Order; the limits are tiered for flows > 75 MGD up to 80 MGD, > 80 MGD up to 85 MGD, > 85 MGD up to 90 MGD, and > 90 MGD.

There are numerous on-going construction projects at the plant site. Most, but not all, are related to the upgrades necessary to achieve compliance with new nutrient limitations. The following are projects currently underway:

1. Rehab/Replacement of 4 Gravity Thickener Tanks (motors, pumps, valves, VFD's, Drives etc)
2. Phase I Nutrient Reduction –Nitrogen – Phosphorus (Rehab Effluent Filter, New methanol storage, rehab ferric system)
3. Phase II – UV system installed (removal of Cl_2 and SO_2) New plant switch gear and power lines.
4. Phase III – Scum system for Primary and Final tanks – Scum concentrator Bld.
5. Phase IV – 2 Additional final tanks, bio-augmentation.
6. Upgrading MIS - computer system and also installing new monitoring equipment (DO, PH, nitrogen etc)

Items evaluated during this inspection include (check all that apply):

[x] Yes	[ ] No		Operational Units
[ ] Yes	[x] No		O & M Manual
[ ] Yes	[x] No		Maintenance Records
[ ] Yes	[x] No	[ ] N/A	Pathogen Reduction & Vector Attraction Reduction
[ ] Yes	[x] No	[ ] N/A	Sludge Disposal Plan
[ ] Yes	[ ] No	[x] N/A	Groundwater Monitoring Plan
[ ] Yes	[ ] No	[x] N/A	Storm Water Pollution Prevention Plan
[x] Yes	[ ] No	[ ] N/A	Permit Special Conditions
[ ] Yes	[ ] No	[ ] N/A	Permit Water Quality Chemical Monitoring
[x] Yes	[ ] No	[ ] N/A	Laboratory Records (see Lab Report – August 15, 2007)

UNIT PROCESS: Screening/Comminution

(Influent Pump Station)

1.	Number of units:	Manual: 0		Mechanical: 2
	Number of units in operation:	Manual: 0		Mechanical: 1
2.	Bypass channel provided?	[x] Yes	[ ] No	
	Bypass channel in use?	[ ] Yes	[x] No	[ ] N/A
3.	Area adequately ventilated?	[x] Yes	[ ] No*	
4.	Alarm system for equipment failure or overloads?	[x] Yes	[ ] No	[ ] N/A
	If present, is the alarm system operational?	[x] Yes	[ ] No *	[ ] N/A
5.	Proper flow-distribution between units?	[x] Yes	[ ] No *	[ ] N/A
6.	How often are units checked and cleaned?	checked hourly; timer activated rake		
7.	Cycle of operation:	Timer controls routine cleaning – runs continuously during high flows		
8.	Volume of screenings removed:	Varies. 3,000-5,000 lbs/day		
9.	General condition:	[x] Good	[x] Fair	[ ] Poor*

Comments: The screens may be bypassed by closing the preceding gate; all flow would back up to the supplemental pump station, which would pump the wastewater though the plant via the secondary screens and grit channels. Grab samples are manually collected hourly from the influent channel. The 2 units are alternated about every 2 – 3 weeks to clean the grit channels associated with each screen. #4. The differential head function that activates the operation of the screens no longer works (previous inspection). #6. Units are monitored via the MIS system by the staff at the influent lift station.

UNIT PROCESS: Grit Removal

1.	Number of units:	4		
	Number of units in operation:	2		
2.	Unit adequately ventilated?	[x] Yes	[ ] No *	
3.	Operation of grit collection equipment:	[x] Manual	[ ] Time clock	[ ] Continuous duty
4.	Proper flow-distribution between units?	[x] Yes	[ ] No *	[ ] N/A
5.	Daily volume of grit removed:	Varies. Avg. 3,000-5,000 lbs/day		
6.	All equipment operable?	[x] Yes	[ ] No *	
7.	General condition:	[x] Good	[x] Fair	[ ] Poor*

Comments: #1. The grit channels are alternated every 2 – 3 weeks. #3. Grit is manually removed by Gantry crane and bucket. The grit is taken to pad for draining and disposed of at the Waste Management facility in Charles City Co.

UNIT PROCESS: Sewage Pumping

1. Name of station: ***Influent Lift Station***
2. Location (if not at STP): ***N/A***
3. Following equipment operable:
   a. All pumps? [x] Yes [ ] No*
   b. Ventilation? [x] Yes [ ] No* [ ] N/A
   c. Control system? [x] Yes [ ] No* [ ] N/A
   d. Sump pump? [x] Yes [ ] No* [ ] N/A
   e. Seal water system? [ ] Yes [ ] No* [x] N/A

4. Reliability considerations:
   a. Class [x] I [ ] II [ ] III
   b. Alarm system operable? [x] Yes [ ] No [ ] N/A
   c. Alarm conditions monitored:
      1. high water level: [x] Yes [ ] No* [ ] N/A
      2. high liquid level in dry well: [x] Yes [ ] No* [ ] N/A
      3. main electric power: [x] Yes [ ] No* [ ] N/A
      4. auxiliary electric power: [ ] Yes [ ] No* [x] N/A
      5. failure of pump motors to start: [ ] Yes [ ] No* [x] N/A
      6. test function: [x] Yes [ ] No*
      7. other: variable frequency drive
   d. Backup for alarm system operational? [ ] Yes [ ] No* [x] N/A
   e. Alarm signal reported to (identify): local audible & visual (panel), control bldg., and SKADA
   f. Continuous operability provisions:
      1. Generator hook up? [ ] Yes [x] No
      2. Two sources of electricity? [x] Yes [ ] No (two power feeds)
      3. Portable pump? [ ] Yes [x] No
      4. 1 day storage? [ ] Yes [x] No
      5. other: N/A

5. Does station have bypass? [ ] Yes* [x] No
   a. Evidence of bypass use? [ ] Yes* [ ] No [x] N/A
   b. Can bypass be disinfected? [ ] Yes [ ] No* [x] N/A
   c. Can bypass be measured? [ ] Yes [ ] No* [x] N/A

6. How often is station checked? manned 24 hours

7. General condition: [x] Good [ ] Fair [ ] Poor*

Comments: #3a. There are 4 variable speed main pumps; all are operational. #4e. The lift station's high-level alarms report to operator enunciator panel, MIS system, and local audio visual. Richmond's three pump stations, Douglasdale Ave., Hampton Street and Upham Brook, each signal alarms to the operator's enunciator panel and MIS. #5. The main lift station has a supplemental pump station, for backup.

UNIT PROCESS: Flow Measurement

[x] Influent [ ] Intermediate [ ] Effluent

1.	Type measuring device:	66" Venturi pressure differential		
2.	Present reading:	Not checked		
3.	Bypass channel?	[x] Yes	[ ] No	
	Metered?	[x] Yes	[ ] No*	[ ] N/A
4.	Return flows discharged upstream from meter?	[ ] Yes	[x] No	
	If Yes, identify:	N/A		
5.	Device operating properly?	[x] Yes	[ ] No*	
6.	Date of last calibration:	Mag meter not calibrated, but readout's electronics are checked annually as a scheduled maintenance task		
7.	Evidence of following problems:			
	a. Obstructions?	[ ] Yes*	[x] No	
	b. Grease?	[ ] Yes*	[x] No	
8.	General condition:	[x] Good	[ ] Fair	[ ] Poor*

Comments: This meter is located on the lower level of the main influent pump station. #6 Mag meters cannot be "calibrated." However, Richmond annually checks the meter's electronics as a scheduled maintenance task.

UNIT PROCESS: Sewage Pumping

1. Name of station: ***Supplemental Lift Station***
2. Location (if not at STP): ***N/A***
3. Following equipment operable:

a. All pumps?	[x] Yes	[ ] No*	
b. Ventilation?	[x] Yes	[ ] No*	[ ] N/A
c. Control system?	[x] Yes	[ ] No*	[ ] N/A
d. Sump pump?	[x] Yes	[ ] No*	[ ] N/A
e. Seal water system?	[ ] Yes	[ ] No*	[x] N/A

4. Reliability considerations:

a. Class	[x] I	[ ] II	[ ] III
b. Alarm system operable?	[x] Yes	[ ] No	[ ] N/A
c. Alarm conditions monitored:			
1. high water level:	[x] Yes	[ ] No*	[ ] N/A
2. high liquid level in dry well:	[x] Yes	[ ] No*	[ ] N/A
3. main electric power:	[x] Yes	[ ] No*	[ ] N/A
4. auxiliary electric power:	[ ] Yes	[ ] No*	[x] N/A
5. failure of pump motors to start:	[ ] Yes	[ ] No*	[x] N/A
6. test function:	[x] Yes	[ ] No*	
7. other:			
d. Backup for alarm system operational?	[ ] Yes	[ ] No*	[x] N/A
e. Alarm signal reported to (identify):	local audible & visual (panel), control bldg.		
f. Continuous operability provisions:			
1. Generator hook up?	[ ] Yes	[x] No	
2. Two sources of electricity?	[x] Yes	[ ] No (two power feeds)	
3. Portable pump?	[ ] Yes	[x] No	
4. 1 day storage?	[ ] Yes	[x] No	
5. other:	N/A		

5. Does station have bypass?	[x] Yes*	[ ] No	See comments below
a. Evidence of bypass use?	[x] Yes*	[ ] No	[ ] N/A
b. Can bypass be disinfected?	[x] Yes	[ ] No*	[ ] N/A
c. Can bypass be measured?	[x] Yes	[ ] No*	[ ] N/A

6. How often is station checked? when in use

7. General condition: [X] Good [ ] Fair [ ] Poor*

Comments: Under normal operating conditions this station is bypassed. The main service line flows into this wet well and the wastewater passes through by gravity to the mechanical screen/grit channels and then on to the influent lift station.

UNIT PROCESS: Screening/Comminution

(Secondary)

1.	Number of units:	Manual: 0		Mechanical: 4
	Number of units in operation:	Manual: 0		Mechanical: 4
2.	Bypass channel provided?	[ ] Yes	[x] No	
	Bypass channel in use?	[ ] Yes	[ ] No	[x] N/A
3.	Area adequately ventilated?	[x] Yes	[ ] No*	
4.	Alarm system for equipment failure or overloads?	[x] Yes	[ ] No	[ ] N/A
	If present, is the alarm system operational?	[x] Yes	[ ] No *	[ ] N/A
5.	Proper flow-distribution between units?	[x] Yes	[ ] No *	[ ] N/A
6.	How often are units checked and cleaned?	once every 2 hours		
7.	Cycle of operation:	timer set based on flow		
8.	Volume of screenings removed:	Avg. 3-5 lbs/da***y***		
9.	General condition:	[ ] Good	[x] Fair	[ ] Poor*

Comments: Located near supplemental pump station. Under normal operating conditions the Main influent Lift station pumps the wastewater to these screens; if the influent is being diverted to the supplemental pump station, that lift station pumps the wastewater directly to these screens. The four screens are operated in parallel.

UNIT PROCESS: Grit Removal

1.	Number of units:	4			
	Number of units in operation:	4			
2.	Unit adequately ventilated?	[x] Yes	[ ] No *		
3.	Operation of grit collection equipment:	[x] Manual	[ ] Time clock	[ ] Continuous duty	[ ] N/A
4.	Proper flow-distribution between units?	[x] Yes	[ ] No *	[ ] N/A	
5.	Daily volume of grit removed:	Not determined, manually cleaned occasionally			
6.	All equipment operable?	[ ] Yes	[x] No *		
7.	General condition:	[ ] Good	[x] Fair	[ ] Poor*	

Comments: #1. The 2° automatic grit removal equipment has been removed, however, grit is regularly removed from the grit settling channel by portable crane and bucket.

UNIT PROCESS: Sedimentation

[x] Primary [ ] Secondary [ ] Tertiary

1.	Number of units:	4 clarifiers, each with forebays
	In operation:	4
2.	Proper flow-distribution between units?	[x] Yes [ ] No* [ ] N/A
3.	Signs of short-circuiting and/or overloads?	[ ] Yes* [x] No
4.	Effluent weirs level?	[x] Yes [ ] No* [ ] N/A
	Clean?	[x] Yes [ ] No*
5.	Scum-collection system working properly?	[x] Yes [ ] No* [ ] N/A
6.	Sludge-collection system working properly?	[x] Yes [ ] No* [ ] N/A
7.	Influent, effluent baffle systems working properly?	[x] Yes [ ] No* [ ] N/A
8.	Chemical addition?	[ ] Yes [x] No
	Chemicals:	None
9.	Effluent characteristics:	Turbid (normal)
10.	General condition:	[ ] Good [X] Fair [ ] Poor*

Comments: #6. The sludge is raked from the bottom of the tank, sent to the de-gritter, and then flows by gravity to the gravity thickeners.

UNIT PROCESS: Sludge Pumping

(Primary to Degritters)

1. Number of Pumps: 5

   Number of pumps in operation: 4 (1 per clarifier) and one in reserve

2. Type of sludge pumped: [x] Primary [ ] Secondary [ ] Return Activated [ ] Combination [ ] Other:

3. Type of pump: [ ] Plunger [ ] Diaphragm [ ] Screw lift [x] Centrifugal [ ] Progressing cavity [ ] Other:

4. Mode of operation: [x] Manual [ ] Automatic [ ] Other:

5. Sludge volume pumped: 2.7 MGD cumulative volume to date for August 09

6. Alarm system for equipment failures or overloads operational? [ ] Yes [ ] No* [X] N/A

7. General condition: [x] Good [ ] Fair [ ] Poor*

Comments: #4. Pumps run continuously.

UNIT PROCESS: Activated Sludge Aeration

1. Number of units: 4
   Number of units in operation: 4

2. Mode of operation: conventional

3. Proper flow distribution between units? [x] Yes [ ] No* [ ] N/A

4. Foam control operational? [x] Yes [ ] No* [ ] N/A

5. Scum control operational? [ ] Yes [ ] No* [x] N/A

6. Evidence of the following problems:
   a. Dead spots? [ ] Yes* [x] No
   b. Excessive foam? [ ] Yes* [x] No
   c. Poor aeration? [ ] Yes* [x] No
   d. Excessive aeration? [ ] Yes* [x] No
   e. Excessive scum? [ ] Yes* [x] No
   f. Aeration equipment malfunction? [ ] Yes* [x] No
   g. Other:

7. Mixed liquor characteristics (as available)

pH:	7.3 SU	MLSS:	2041, 1960, 3620, 3700 mg/L (daily average)
DO:	5.7, 4.8, 6.0, 5.0 mg/L	SDI:	
SVI:	____	Color:	Good
Odor:	Normal	Settleability:	ml/l
		Other:	MLVSS: %

8. Return/waste sludge:
   a. return rate: 10.6 MGD
   b. waste rate: West = 0.3507 MGD
      East = 0.0821 MGD
   c. frequency of wasting: continuous

9. Aeration system control: [ ] Time Clock [ ] Manual [x] Continuous
   [ ] Other

10. Effluent control devices working properly (oxidation ditches)? [ ] Yes [ ] No [x] N/A

11. General condition: [x] Good [ ] Fair [ ] Poor *

Comments: #2. Each basin is baffled to provide 4 "passes." The influent wastewater is fed to the second pass, which is an anoxic zone and the return is fed to the first pass. #s 6 and 7, Visual observation of the mixed liquor indicated good color, consistency, odor and settling characteristics.

UNIT PROCESS: Sedimentation

[ ] Primary [x] Secondary [ ] Tertiary

1.	Number of units:	6		
	In operation:	5		
2.	Proper flow-distribution between units?	[x] Yes	[ ] No*	[ ] N/A
3.	Signs of short-circuiting and/or overloads?	[ ] Yes*	[x] No	
4.	Effluent weirs level?	[x] Yes	[ ] No*	[ ] N/A
	Clean?	[x] Yes	[ ] No*	
5.	Scum collection system working properly?	[x] Yes	[ ] No*	[ ] N/A
6.	Sludge-collection system working properly?	[x] Yes	[ ] No*	[ ] N/A
7.	Influent, effluent baffle systems working properly?	[x] Yes	[ ] No*	[ ] N/A
8.	Chemical addition?	[ ] Yes	[x] No	
	Chemicals:	none		
9.	Effluent characteristics:	clear		
10.	General condition:	[x] Good	[ ] Fair	[ ] Poor*

Comments: #5. Any scum that passes through from the 1° sedimentation tanks and the aeration basins is collected at the baffle in the 2° sedimentation tank and prevented from being discharged.

UNIT PROCESS: Sludge Pumping

(RAS to aeration tank)

1. Number of Pumps: 9
   Number of pumps in operation: 6 are alternately run at a time. 3 are held in reserve.

2. Type of sludge pumped: [ ] Primary [ ] Secondary [x] Return Activated
   [ ] Combination [ ] Other:

3. Type of pump: [ ] Plunger [ ] Diaphragm [ ] Screw lift
   [x] Centrifugal[ ] Progressing cavity [ ] Other:

4. Mode of operation: [x] Manual [ ] Automatic [ ] Other:

5. Sludge volume pumped: 10.6 MGD cumulative average to date for August

6. Alarm system for equipment failures or overloads operational? [x] Yes [ ] No* [ ] N/A

7. General condition: [x] Good [ ] Fair [ ] Poor*

Comments: The pumps are configured so that 3 pumps serve 2 clarifiers; one lead for each clarifier and one as back up for either. #4. The pumps operate continuously.

UNIT PROCESS: Sludge Pumping

(WAS to the Thickening Centrifuge)

1. Number of Pumps: 3
   Number of pumps in operation: 1

2. Type of sludge pumped: [ ] Primary [ ] Secondary [ ] Return Activated
   [ ] Combination [x] Other: WAS

3. Type of pump: [ ] Plunger [ ] Diaphragm [ ] Screw lift
   [x] Centrifugal[ ] Progressing cavity [ ] Other:

4. Mode of operation: [x] Manual [ ] Automatic [ ] Other:

5. Sludge volume pumped: 0.3961 MG cumulative average to date for August

6. Alarm system for equipment failures or overloads operational? [x] Yes [ ] No* [ ] N/A

7. General condition: [x] Good [ ] Fair [ ] Poor*

Comments: WAS is pulled off the RAS lines and pumped to the thickening centrifuges. #4. Pumps run continuously at variable speed.

UNIT PROCESS: Centrifugation

(WAS *Thickening Centrifuge*)

1.	Number of units:	4		
	Number in operation:	1		
2.	Purpose of centrifuge(s):	[x] Thickening	[ ] Dewatering	[ ] Other:
3.	Operation of equipment:	[x] Manual	[ ] Automatic	[ ] Other:
4.	Centrifuge run time:	Based on flow and MLSS		
5.	Influent sludge flow rate:	See comment, below		
6.	Amount cake produced:	See comment, below		
7.	Percent solids in influent:	See comment, below		
	Percent solids in effluent:	See comment, below		
8.	Conditioning chemical fed:	none		
	Dose:	N/A		
9	Centrate return location:	Primary clarifiers		
	Sign of problems?	[ ] Yes*	[x] No	
10	General Condition:	[x] Good	[ ] Fair	[ ] Poor*

Comments: These centrifuges are used to thicken WAS on its way to the digesters. The flow is manually controlled by the waste rate and/or changing the number of centrifuges on line. #'s 5,6,7 and 8 Sludge production/operational data was not recorded this inspection, however visual observation of the equipment indicated that the centrifuges are in good condition and operating as designed. One unit was out for major maintenance. #8. Polymer feed system available but not in use**.**

UNIT PROCESS: Sludge Pumping (WAS)

(Thickening Centrifuges to the Digesters)

1. Number of Pumps: 4
   Number of pumps in operation: 1

2. Type of sludge pumped: [ ] Primary [ ] Secondary [ ] Return Activated
   [ ] Combination [x] Other: Thickened WAS

3. Type of pump: [ ] Plunger [ ] Diaphragm [ ] Screw lift
   [ ] Centrifugal [x] Progressing cavity [ ] Other:

4. Mode of operation: [ ] Manual [x] Automatic [ ] Other:

5. Sludge volume pumped: Not ascertained

6. Alarm system for equipment failures or overloads operational? [x] Yes [ ] No* [ ] N/A

7. General condition: [x] Good [ ] Fair [ ] Poor*

Comments: Each of the 2 sludge pits is served by 2 pumps. #5 Sludge production/operational data was not recorded this inspection, however visual observation of the equipment indicated that the centrifuges are in good condition and operating as designed

UNIT PROCESS: Grit Removal (Primary Sludge via Cyclone Degritters)

1.	Number of units:	3, each w/ 2 classifiers		
	Number of units in operation:	2 in service at a time		
2.	Unit adequately ventilated?	[x] Yes	[ ] No *	
3.	Operation of grit collection equipment:	[x] Manual	or Continuous duty	
4.	Proper flow-distribution between units?	[ ] Yes	[ ] No *	[x] N/A
5.	Volume of grit removed:	265,980 lbs in July '09		
6.	All equipment operable?	[x] Yes	[ ] No *	
7.	General condition:	[x] Good	[ ] Fair	[ ] Poor*

Comments: Under normal conditions all primary sludge is processed through the degritters. There is one classifier per primary clarifier with 2 backup classifiers. The degritted primary sludge flows by gravity to the gravity thickeners.

UNIT PROCESS: Gravity Thickening

(Primary Sludge)

1.	Number of units:	4			
	Number of units in operation:	3 (one being overhauled)			
2.	Types of sludge(s) fed to the thickener:	[x] Primary	[ ] WAS	[ ] Combination	[ ] Other:
3.	Solids concentration in the influent sludge:	2602 mg/l as TSS			
	Solids concentration in thickened sludge:	5.2% running average for August, to date			
4.	Sludge feeding:	[x] Continuous		[ ] Intermittent	
5.	Signs of short-circuiting and/or overloads?	[ ] Yes*	[x] No	[ ] N/A	
6.	Effluent weirs level?	[x] Yes	[ ] No *	[ ] N/A	
7.	Sludge collection system work properly?	[x] Yes	[ ] No *	[ ] N/A	
8.	Influent, effluent baffle systems work properly?	[x] Yes	[ ] No *	[ ] N/A	
9.	Chemical addition?	[ ] Yes	[x] No *	[ ] N/A	
	Identify chemical/dose:	N/A			
10.	General condition:	[x] Good	[ ] Fair	[ ] Poor*	

Comments: None

UNIT PROCESS: Sludge Pumping

(Gravity Thickened Primary Sludge to the "Mixed Loop")

1. Number of Pumps: 8
   Number of pumps in operation: 3
2. Type of sludge pumped: [X] Primary [ ] Secondary [ ] Return Activated [ ] Combination [X] Other: Thickened Primary
3. Type of pump: [ ] Plunger [ ] Diaphragm [ ] Screw lift [ ] Centrifugal [X] Progressing cavity [ ] Other:
4. Mode of operation: [X] Manual [ ] Automatic [ ] Other:
5. Sludge volume pumped: Not ascertained
6. Alarm system for equipment failures or overloads operational? [x] Yes [ ] No* [ ] N/A
7. General condition: [x] Good [ ] Fair [ ] Poor*

Comments: One pump and one back-up pump for each or 4 tanks. One tank is currently out for maintenance and two pumps are scheduled for replacement. These pumps pump the gravity thickened sludge to the mixed loop where it joins the WAS on its way to the digesters. #5. Sludge volume pumped was not checked this inspection, however the digesters were operating as designed and there were no obvious problems due to insufficiently thickened sludge**.**

UNIT PROCESS: Anaerobic Digestion

1.	Number of units:	5 heated primary; 1 secondary (holding tank), 4 holding tanks
	Number of units in operation:	5 primary; 1 holding tank (2°); 2 holding tanks
2.	Type of sludge digested:	Primary and WAS
3.	Type of digester:	[x] Primary [x] High Rate [x] 2° Holding Tank [ ] Standard Rate
4.	Frequency of sludge application to digesters:	continuous (one at a time)
5.	Number of recirculation pumps:	11 plus 2 for holding tank
	Number in operation:	all operational
6.	Sludge retention time:	Average of 20 days in August, to date.
7.	Provisions for pH adjustment?	[x] Yes [ ] No
	pH adjustment utilized?	[ ] Yes [x] No [ ] N/A
8.	Location of supernatant return:	[ ] Head [ ] Primary [ ] Other: N/A
9.	Gas production rate:	Not metered
10.	Process control testing:	
	a. reduction of volatile solids:	[x]Yes [ ] No
	b. volatile acids:	[x] Yes [ ] No
	c. pH	[x] Yes [ ] No
	d. temperature:	[x] Yes [ ] No
	e. alkalinity:	[x] Yes [ ] No
11.	Signs of overloading?	[ ] Yes* [x] No
12.	General condition:	[x] Good [ ] Fair [ ] Poor*

Comments: Sludge is fed to the five primary digesters one at a time; the pumps automatically alternate the digester receiving the sludge. While a digester is being fed, the digested sludge is gravity fed to the Holding Tank (2° digester). #6. Sludge is recirculated in the Holding Tank (2° digester) and gas is produced, but no heat is provided. The sludge from the Holding Tank (2° digester) is gravity fed to one of the 2 sludge holding tanks, which are outside and open to the atmosphere. #8 The digesters are not decanted. All flow goes to centrifuges. #9. The methane gas is used to fuel the boilers and supply heat to the digesters. #12 The digesters were reported to be fully operational and there were no obvious indicators (odors, problems associated with supernatant return, etc) of operational problems.

UNIT PROCESS: Sludge Pumping (WAS)

(Sludge Holding Tanks to the Dewatering Centrifuges)

1. Number of Pumps: 6
   Number of pumps in operation: depends on number of centrifuges running, all are operational

2. Type of sludge pumped: [ ] Primary [ ] Secondary [ ] Return Activated
   [ ] Combination [x] Other: Digested Primary and WAS

3. Type of pump: [ ] Plunger [ ] Diaphragm [ ] Screw lift
   [ ] Centrifugal [x] Progressing cavity [ ] Other:____

4. Mode of operation: [x] Manual [ ] Automatic [ ] Other:____

5. Sludge volume pumped: Amount unknown. Recorded as Wet tons/day as finished cake
6. Alarm system for equipment failures or overloads operational? [x] Yes [ ] No* [ ] N/A

7. General condition: [x] Good [ ] Fair [ ] Poor*

Comments: These pumps are run manually as needed to manage the sludge, usually 12 hours/day, 7 days/week, but sometimes up to 16 hours/day. #5 No operational data was obtained this inspection.

UNIT PROCESS: Centrifugation
(Dewatering Digested Sludge)

1.	Number of units: Number in operation:	5 4 operational; 1 undergoing maintenance
2.	Purpose of centrifuge(s):	[ ] Thickening [x] Dewatering [ ] Other:
3.	Operation of equipment:	[x] Manual [ ] Automatic [ ] Other:
4.	Centrifuge run time:	12 hrs./day, 7 days/week
5.	Influent sludge flow rate:	0.2473 MGD
6.	Amount cake produced:	47.6 Wet tons per day in August, to date. 1801 wet tons were pumped in July for an average of 58.1 Wet tons per day.
7.	Percent solids in influent: Percent solids in effluent:	Not ascertained Not ascertained
8.	Conditioning chemical fed: Dose:	cationic polymer Not ascertained
9	Centrate return location: Sign of problems?	primary clarifiers [ ] Yes* [x] No
10	General Condition:	[x] Good [ ] Fair [ ] Poor*

Comments: Sludge is pumped from the holding tanks to each centrifuge. Dewatered sludge is placed on a holding pad until hauled away by contractor. The sludge holding pad is enclosed on three sides with concrete walls. The sludge is treated to meet Class B requirements, Pathogen Control Alternative 2, Vector Attraction Reduction Option 1. The minimum detention time required is temperature dependent: 15 days at 35°C – 60 days at 20°C. #'s 5, 6, 7 and 8. All centrifuges in operation appeared to be in good condition and the quality of the sludge being produced was excellent by visual standards The sludge on the pad at the time of the inspection was said to have a solids content of over 26%.

UNIT PROCESS: Filtration (Tertiary)

1.	Type of filters:	[x] Gravity	[ ] Pressure	[ ] Intermittent	
2.	Number of units:	18			
	Number in operation:	18			
3.	Operation of system:	[x] Automatic	[ ] Semi-automatic		
		[ ] Manual	[ ] Other (specify):		
4.	Proper flow-distribution between units?	[x] Yes	[ ] No*	[ ] N/A	
5.	Evidence of following problems:				
	a. Uneven flow distribution?	[ ] Yes*	[x] No	[ ] N/A	
	b. Filter clogging (ponding)?	[ ] Yes*	[ ] No	[x] N/A	
	c. Nozzles clogging?	[ ] Yes*	[ ] No	[x] N/A	
	d. Icing?	[ ] Yes*	[x] No	[ ] N/A	
	e. Filter flies?	[ ] Yes*	[ ] No	[x] N/A	
	f. Vegetation on filter?	[ ] Yes*	[x] No	[ ] N/A	
6.	Filter aid system provided?	[x] Yes	[ ] No		
	Properly operating? (if needed)	[ ] Yes	[ ] No*	[x] N/A Not Needed	
	Chemical used:	N/A			
7.	Automatic valves properly operating?	[x] Yes	[ ] No*	[ ] N/A	
8.	Valves sequencing correctly?	[x] Yes	[ ] No*	[ ] N/A	
9.	Backwash system operating properly?	[x] Yes	[ ] No*	[ ] N/A	
10.	Filter building adequately ventilated?	[ ] Yes	[ ] No*	[x] N/A	
11.	Effluent characteristics:	very clear			
12.	General condition:	[x] Good	[ ] Fair	[ ] Poor*	

Comments: There are 4 backwash pumps (2 per side) – typically one pump is on-line for each side with the other one as a back-up. The filters backwash every 36-40 hours; backwash water returns to the primary effluent trough. The system is able to automatically backwash if the water reaches a preset high level.

NOTE: One half of these filters will be taken off line on or about August 12, 2009 as part of a major plant (nutrient) upgrade. They will remain off line until approximately January of 2010.

UNIT PROCESS: Chlorination

1.	Number of chlorinators:	*3*
	Number in operation:	*1*
2.	Number of evaporators:	*3*
	Number in operation:	*1*
3.	Number of chlorine contact tanks:	*1*
	Number in operation:	*1*
4.	Proper flow-distribution between units?	[ ] Yes [ ] No * [X] N/A
5.	How is chlorine introduced into the wastewater?	[x] Perforated diffusers [ ] Injector with single entry point [ ] Other
6.	Chlorine residual in basin effluent:	1.0 mg/L at 0900 - 8/11/09.
7.	Applied chlorine dosage:	~ 1700 lbs per day (Average)
8.	Contact basins adequately baffled?	[x] Yes [ ] No * [ ] N/A
9.	Adequate ventilation in:	
	a. Chemical storage area?	[ ] Yes [ ] No * [x] N/A (railcar)
	b. Equipment room?	[x] Yes [ ] No * [ ] N/A
10.	Proper safety precautions used?	[x] Yes [ ] No *
11.	General condition:	[x] Good [ ] Fair [ ] Poor*

Comments: The facility has a good safety program in place.

UNIT PROCESS: Post Aeration

1.	Number of units:	1			
	Number of units in operation:	1			
2.	Proper flow distribution between units?	[ ] Yes	[ ] No*	[x] N/A	
3.	Evidence of following problems:				
a.	Dead spots?	[ ] Yes*	[x] No		
b.	Excessive foam?	[ ] Yes*	[x] No		
c.	Poor aeration?	[ ] Yes*	[x] No		
d.	Mechanical equipment failure?	[ ] Yes*	[x] No	[ ] N/A	
4.	How is the aerator controlled?	[ ] Time clock	[ ] Manual	[x] Continuous	
		[ ] Other _____		[ ] N/A	
5.	What is the current operating schedule?	Continuous			
6.	Step weirs level?	[ ] Yes	[ ] No*	[x] N/A	
7.	Effluent D.O. level:	Not checked this inspection			
8.	General condition:	[x] Good	[ ] Fair	[ ] Poor*	

Comments: Post aeration shares 4 blowers with the aeration basins. Aeration occurs at the head of the chlorine contact tank, providing good mixing for the chlorine.

UNIT PROCESS: Dechlorination

1.	Chemical used:	[x] Sulfur Dioxide [ ] Bisulfite [ ] Other
2.	Number of sulfonators:	2
	Number in operation:	1
3.	Number of evaporators:	2
	Number in operation:	1
4.	Number of chemical feeders:	0
	Number in operation:	0
5.	Number of contact tanks:	1 mixer
	Number in operation:	1
6.	Proper flow-distribution between units?	[ ] Yes [ ] No * [x] N/A
7.	How is chemical introduced?	[X] Perforated diffusers [ ] Injector with single entry point [ ] Other
8.	Control system operational?	[x] Yes [ ] No *
	a. Residual analyzers?	[x] Yes [ ] No * [ ] N/A
	b. System adjusted:	[ ] Automatic [x] Manual [ ] Other:
9.	Applied dechlorinating dose:	837 lbs/day (average for July, '09)
10.	Chlorine residual in basin effluent:	< QL (Actual reading 0.06 mg/l)
11.	Contact basins adequately baffled?	[ ] Yes [ ] No * [x] N/A
12.	Adequate ventilation in:	
	a. Chemical storage area?	[ ] Yes [ ] No * [x] N/A (railcar)
	b. Equipment room?	[x] Yes [ ] No *
13.	Proper safety precautions used?	[x] Yes [ ] No *
14.	General condition:	[x] Good [ ] Fair [ ] Poor*

Comments: None

UNIT PROCESS: Flow Measurement

(VPDES Outfall No. 001)

1.	Type measuring device:	66" In-Line Magnetic Meter (not used for low flows)
2.	Present reading:	Not recorded this inspection
3.	Bypass channel? Metered?	[x] Yes [ ] No [x] Yes [ ] No* [ ] N/A
4.	Return flows discharged upstream from meter? If Yes, identify:	[x] Yes [ ] No filter backwash
5.	Device operating properly?	[x] Yes [ ] No*
6.	Date of last calibration:	Mag meter not calibrated, but readout's electronics are checked annually as scheduled maintenance task
7.	Evidence of following problems: a. Obstructions? b. Grease?	[ ] Yes* [x] No [ ] Yes* [x] No
8.	General condition:	[x] Good [ ] Fair [ ] Poor*

Comments: An in-line mag meter monitors effluent flow, but if flow is not high enough to fill the pipe, accuracy of the meter can be affected. Therefore, the flow is also manually measured every two hours at the stilling well at the end of the contact tank. This manual reading is checked against the Mag meter to insure accuracy of the reported data. #6 Mag meters cannot be "calibrated." However, Richmond annually checks the meter's electronics. The current Mag meter is scheduled to be replaced as part of the ongoing plant upgrade.

UNIT PROCESS: Effluent/Plant Outfall

1. Type outfall: [x] Shore based [ ] Submerged

2. Type if shore based: [x] Wing wall [ ] Headwall [ ] Rip Rap [ ] N/A

3. Flapper valve? [ ] Yes [ ] No [x] N/A

4. Erosion of bank? [ ] Yes* [x] No [ ] N/A

5. Effluent plume visible? [x] Yes * [ ] No

Comments: Very clear effluent flows into the James River, creating a plume of clear water in the turbid river.

6. Condition of outfall and supporting structures: [x] Good [ ] Fair [ ] Poor *

7. Final effluent, evidence of following problems:

   a. Oil sheen? [ ] Yes* [x] No

   b. Grease? [ ] Yes* [x] No

   c. Sludge bar? [ ] Yes* [x] No

   d. Turbid effluent? [ ] Yes* [x] No

   e. Visible foam? [ ] Yes* [x] No

   f. Unusual odor? [ ] Yes* [x] No

Comments: The effluent was very clear.

cc:

[x] Owner: c/o Robert Steidel

[ ] Operator:

[ ] Local Health Department:

[x] DEQ - OWCP, attn: Steve Stell

[x] DEQ - Regional Office File

[x] EPA - Region III

Attachment E

Effluent Data

Application Data

Parameter	Maximum Daily Value		Average Daily Value		
	Value	Units	Value	Units	No. Samples
pH (minimum)	4.20	S.U.			
pH (maximum)	8.6	S.U.			
Flow Rate	85.00	MGD	54.90	MGD	1827
Temperature (Winter)	15.70	°C	14.50	°C	848
Temperature (Summer)	31.30	°C	24.50	°C	612

Pollutant	Maximum Daily Discharge		Average Daily Discharge		
	Conc.	Units	Conc.	Units	No. Samples
$cBOD_5$	64.70	mg/L	3.20	mg/L	1827
Fecal Coliform	2420	N/100 mL	10	N/100 mL	1006
TSS	129.00	mg/L	4.00	mg/L	1826

Water Quality Standards Testing

CASRN#	CHEMICAL	REQUIRED QUANTIFICATION LEVEL	REPORTING RESULTS (µg/L)
METALS			
7440-36-0	Antimony, dissolved	4.2E4	<80, <80, <80
7440-38-2	Arsenic, dissolved	480	<60, <60, <60
7440-43-9	Cadmium, dissolved	4.3	0.13, <0.1, <0.1
16065-83-1	Chromium III, dissolved [8]	280	<10, <10, <10
18540-29-9	Chromium VI, dissolved [8]	22	<10, <10, <10
7440-50-8	Copper, dissolved	17	5, <5, 8
7439-92-1	Lead, dissolved	47	<20, <20, <20
7439-97-6	Mercury, dissolved	0.50	<0.1, <0.1, <0.1
7440-02-0	Nickel, dissolved	76	<10, <10, <10
7782-49-2	Selenium, Total Recoverable	21	<5
7440-22-4	Silver, dissolved	4.2	<0.5, <0.5, <0.5
7440-28-0	Thallium, dissolved	n/a	<40, <40, <40
7440-66-6	Zinc, dissolved	150	50, 41, 42
PESTICIDES/PCB'S			
309-00-2	Aldrin	0.05	<0.05
57-74-9	Chlordane	0.2	ND
2921-88-2	Chlorpyrifos (synonym = Dursban)	n/a	<0.1
72-54-8	DDD	0.1	<0.05
72-55-9	DDE	0.1	<0.05
50-29-3	DDT	0.1	<0.05
8065-48-3	Demeton	n/a	<0.1
333-41-5	Diazinon	n/a	<1
60-57-1	Dieldrin	0.1	<0.05
959-98-8	Alpha-Endosulfan	0.1	<0.05
33213-65-9	Beta-Endosulfan	0.1	<0.05

CASRN#	CHEMICAL	REQUIRED QUANTIFICATION LEVEL	REPORTING RESULTS (µg/L)
1031-07-8	Endosulfan Sulfate	0.1	<0.05
72-20-8	Endrin	0.1	<0.05
7421-93-4	Endrin Aldehyde	n/a	<0.05
86-50-0	Guthion	n/a	<0.1
76-44-8	Heptachlor	0.05	<0.05
1024-57-3	Heptachlor Epoxide	n/a	<0.05
319-84-6	Hexachlorocyclohexane Alpha-BHC	n/a	<0.05
319-85-7	Hexachlorocyclohexane Beta-BHC	n/a	<0.05
58-89-9	Hexachlorocyclohexane Gamma-BHC or Lindane	n/a	<0.05
143-50-0	Kepone	n/a	<1.0
121-75-5	Malathion	n/a	<0.1
72-43-5	Methoxychlor	n/a	<0.05
2385-85-5	Mirex	n/a	<0.05
56-38-2	Parathion	n/a	<0.1
1336-36-3	PCB Total	7.0	ND
8001-35-2	Toxaphene	5.0	ND
BASE NEUTRAL EXTRACTABLES			
83-32-9	Acenaphthene	10.0	<10, <10, <10
120-12-7	Anthracene	10.0	<10, <10, <10
92-87-5	Benzidine	n/a	<10, <10, <10
56-55-3	Benzo (a) anthracene	10.0	<10, <10, <10
205-99-2	Benzo (b) fluoranthene (3,4-benzofluoranthene)	10.0	<10, <10, <10
207-08-9	Benzo (k) fluoranthene	10.0	<10, <10, <10
50-32-8	Benzo (a) pyrene	10.0	<10, <10, <10
111-44-4	Bis 2-Chloroethyl Ether	n/a	<10, <10, <10
108-60-1	Bis 2-Chloroisopropyl Ether	n/a	<10, <10, <10
85-68-7	Butyl benzyl phthalate	10.0	<10, <10, <10
91-58-7	2-Chloronaphthalene	n/a	<10, <10, <10
218-01-9	Chrysene	10.0	<10, <10, <10

CASRN#	CHEMICAL	REQUIRED QUANTIFICATION LEVEL	REPORTING RESULTS (µg/L)
53-70-3	Dibenz(a,h)anthracene	20.0	<10, <10, <10
84-74-2	Dibutyl phthalate (synonym = Di-n-Butyl Phthalate)	10.0	<10, <10, <10
95-50-1	1,2-Dichlorobenzene	10.0	<10, <10, <10
541-73-1	1,3-Dichlorobenzene	10.0	<10, <10, <10
106-46-7	1,4-Dichlorobenzene	10.0	<10, <10, <10
91-94-1	3,3-Dichlorobenzidine	n/a	<10, <10, <10
84-66-2	Diethyl phthalate	10.0	<10, <10, <10
117-81-7	Bis-2-ethylhexyl phthalate	10.0	<10, <10, <10
131-11-3	Dimethyl phthalate	n/a	<10, <10, <10
121-14-2	2,4-Dinitrotoluene	10.0	<10, <10, <10
122-66-7	1,2-Diphenylhydrazine	n/a	<10, <10, <10
206-44-0	Fluoranthene	10.0	<10, <10, <10
86-73-7	Fluorene	10.0	<10, <10, <10
118-74-1	Hexachlorobenzene	n/a	<10, <10, <10
87-68-3	Hexachlorobutadiene	n/a	<10, <10, <10
77-47-4	Hexachlorocyclopentadiene	n/a	<10, <10, <10
67-72-1	Hexachloroethane	n/a	<10, <10, <10
193-39-5	Indeno(1,2,3-cd)pyrene	20.0	<10, <10, <10
78-59-1	Isophorone	10.0	<10, <10, <10
98-95-3	Nitrobenzene	10.0	<10, <10, <10
62-75-9	N-Nitrosodimethylamine	n/a	<10, <10, <10
621-64-7	N-Nitrosodi-n-propylamine	n/a	<10, <10, <10
86-30-6	N-Nitrosodiphenylamine	n/a	<10, <10, <10
129-00-0	Pyrene	10.0	<10, <10, <10
120-82-1	1,2,4-Trichlorobenzene	10.0	<10, <10, <10
VOLATILES			
107-02-8	Acrolein	n/a	<10, <10, <10
107-13-1	Acrylonitrile	n/a	<10, <10, <10
71-43-2	Benzene	10.0	<10, <10, <10

CASRN#	CHEMICAL	REQUIRED QUANTIFICATION LEVEL	REPORTING RESULTS (µg/L)
75-25-2	Bromoform	10.0	<10, <10, <10
56-23-5	Carbon Tetrachloride	10.0	<10, <10, <10
108-90-7	Chlorobenzene (synonym = monochlorobenzene)	50.0	<10, <10, <10
124-48-1	Chlorodibromomethane	10.0	11.5, <10, <10
67-66-3	Chloroform	10.0	13.1, <10, 11.7
75-09-2	Dichloromethane (synonym = methylene chloride)	20.0	<10, <10, <10
75-27-4	Dichlorobromomethane	10.0	11.5, <10, <10
107-06-2	1,2-Dichloroethane	10.0	<10, <10, <10
75-35-4	1,1-Dichloroethylene	10.0	<10, <10, <10
156-60-5	1,2-trans-dichloroethylene	n/a	<10, <10, <10
78-87-5	1,2-Dichloropropane	n/a	<10, <10, <10
542-75-6	1,3-Dichloropropene	n/a	<20, <20, <20
100-41-4	Ethylbenzene	10.0	<10, <10, <10
74-83-9	Methyl Bromide	n/a	<10, <10, <10
79-34-5	1,1,2,2-Tetrachloroethane	n/a	<10, <10, <10
127-18-4	Tetrachloroethylene	10.0	<10, <10, <10
10-88-3	Toluene	10.0	<10, <10, <10
79-00-5	1,1,2-Trichloroethane	n/a	<10, <10, <10
79-01-6	Trichloroethylene	10.0	<10, <10, <10
75-01-4	Vinyl Chloride	10.0	<10, <10, <10
RADIONUCLIDES			
	Uranium	n/a	<0.7 pCi/L
	Radium 226	n/a	0.9 pCi/L
	Radium 228	n/a	<0.9 pCi/L
	Beta Particle & Photon Activity (mrem/yr)	n/a	8.94 pCi/L
	Gross Alpha Particle Activity (pCi/L)	n/a	1.95 pCi/L
	Strontium 90	n/a	<2 pCi/L
	Tritium	n/a	177 pCi/L

CASRN#	CHEMICAL	REQUIRED QUANTIFICATION LEVEL	REPORTING RESULTS (µg/L)
ACID EXTRACTABLES			
95-57-8	2-Chlorophenol	10.0	<10, <10, <10
120-83-2	2,4 Dichlorophenol	10.0	<10, <10, <10
105-67-9	2,4 Dimethylphenol	10.0	<10, <10, <10
51-28-5	2,4-Dinitrophenol	n/a	<10, <20, <10
534-52-1	2-Methyl-4,6-Dinitrophenol (4,6-dinitro-o-creosol)	n/a	<10, <10, <10
25154-52-3	Nonylphenol	n/a	<5
87-86-5	Pentachlorophenol	50.0	<10, <10, <10
108-95-2	Phenol	10.0	<10, <10, <10
88-06-2	2,4,6-Trichlorophenol	10.0	<10, <10, <10
MISCELLANEOUS			
776-41-7	Ammonia as NH3-N	200	See DMR data
16887-00-6	Chlorides	n/a	48 mg/L
7782-50-5	Chlorine, Total Residual	100	See DMR Data
57-12-5	Cyanide, Free	10.0	<10, <10, <10, <10
N/A	*E. coli* / *Enterococcus* (N/CML)	n/a	See DMR data
7783-06-4	Hydrogen Sulfide	n/a	<1.00 mg/L
60-10-5	Tributyltin	n/a	<30 ng/L
	Hardness (mg/L as $CaCO_3$)	n/a	128, 128, 84

Parameters sampled for EPA Form 2A, Part D not addressed above were reported as less than the quantification level.

2006 Effluent Temperature in °C

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
							31.3	22.3	19.9	20	17.8
							25.8	22.5	22.2	20.2	17
							31.3	22.5	23.3	19.4	16.6
							27.6	23.1	24.1	17.8	14.6
							27.9	22.3	23.5	18	13.9
							28.1	22	22.4	17.8	13.4
							26.2	23.8	23.5	17.5	15.6
							26.4	24.4	22.8	18.3	14.7
							26.1	23.5	23.1	19.5	13.9
							24.1	24.3	20.3	19.4	14.2
							23.8	24.9	19.3	22.4	15.6
							24.2	20.1	20.9	21.7	16.9
							25.5	22.9	19	16.7	16.2
							25.6	21.9	18.9	17.2	15.3
							25.9	21.6	18.6	17	15.5
							26.8	21.6	19.6	20.2	16.5
							26.4	22.3	20.5	18	15.8
							23.8	22.3	21.8	18.5	16.9
							24.5	24.2	22	17	16.3
							25.9	24.1	23.1	17.2	15.3
							22.7	23	20.2	16.5	15
							22.5	24.3	20.3	12.3	14.8
							26.5	24.1	20.3	12.2	15.7
							26.1	23.5	19.4	14.4	17.6
							26	23.3	19.6	15.2	15.1
							25.1	22.1	20	15.9	15.2
							26	23.6	19.3	17.4	16.3
							25.8	22.3	19	16.1	15.4
							26.3	20	20.7	16.5	16.2
							26.4	20.2	21.2	18	16.1
							25.2		24.4		16.3

2007 Effluent Temperature in °C

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
16.6	14.1	14.1	17.6	18	22.5	23.5	26.1	25.9	24.1	21.7	19
17	14.2	14.3	18.2	18.5	22	24	26.1	26.1	24.4	20	18.1
14.9	13.7	16.9	17.9	17.4	18.7	24.2	26	25.8	24.8	21.1	18.2
15.9	14.8	16.5	17.7	17.1	21.7	23.8	26.2	25.2	24.3	19.6	17.6
16.1	13.6	13	16.1	18	22.3	24	26.3	25.5	24.9	20.5	17.3
16.7	13.8	13	16	17.5	22.6	24.6	26.4	25.9	25.6	20.6	16.9
16.3	13.2	13.2	14.7	15.1	22.3	24.8	27.1	26.3	25.4	20.1	16.7
16	13.3	13.2	14.8	16.4	23.2	24.6	27.5	26.6	25.2	19	17.1
15.1	13.2	13.2	15	17.7	22.4	25.4	27.9	24.8	25.1	18.5	17.5
15.1	13.1	13.5	16	18.3	22.6	24.8	27.2	26.5	25.5	18.8	18.4
14.5	12.8	13.4	15.7	19.3	22.9	25.5	26.8	26.5	23.6	19	18.3
15.1	12.9	13.8	16.3	17.4	23.1	25.7	26.2	26.4	23.4	19.4	18.4
14.7	14.8	15.2	16.2	15.9	23	25.5	26.5	26	22.2	20	18
15	14.9	15.3	17.2	19.1	17.8	25.2	26.1	26.1	22.6	20.5	17.2
16.7	13.4	19.2	16.7	19.3	22.5	24.5	26.5	24.6	22.3	20.8	15.2
16.9	13.6	15.4	15.7	20.3	22.5	24.6	26.9	23.6	23.7	18	13.6
14.1	13	14.9	17.4	20.1	23	25.5	26	23.8	23	18.3	13.6
13.7	14	14.7	15.4	18	22.8	25.3	25.8	24.2	23.2	18.7	11.4
13.8	13.9	13.8	16	18	24	26.1	25.7	24.5	23.5	17.4	14.2
13.2	13.3	15.1	16	19	21.7	25.8	25.8	24.2	24	19	15.8
12.6	13.4	14.2	17.2	19.9	23.7	25.3	25.8	24	22.2	20.2	15.7
12.4	14	14.8	18.8	18	23.8	25.6	26	24.9	23.3	19.8	15.6
12.5	14.1	15.6	18.6	19.9	21.5	24.8	25.8	25.4	23.8	19.4	15.6
14.2	13.8	15.9	18.8	24.6	22.3	24.6	25.7	24.9	24.4	19.3	15.6
13.5	13.5	16.2	18.5	20.9	23.5	24.5	27.4	25.1	21.4	18.1	15.5
14	14.7	15.7	18.5	21.6	24	24.1	26.3	22.1	22.2	18.4	15.6
14.1	14.9	18	18.4	21.7	24.6	25.5	26.3	25.2	21.6	19.1	12.8
13.6	13.7	17.5	18.2	21.3	25	25	26.5	25.4	21.8	18.9	13.8
13.3		17.7	17.8	22	25	25.5	26.6	24.6	21.2	18.6	15.7
13.7		17.9	18.1	21.9	24.5	25.6	26.3	23.8	21.3	17.7	15.1
13.6		19.7		22.2		25.4	26.1		21.4		12.4

2008 Effluent Temperature in °C

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
14.4	14.5	14.2	16.6	17.9	22	25.1	27.2	26.4	24.4	21.2	14.7
13.8	14.7	14.5	17.6	18.3	21.8	24.8	27	25.4	24.4	21.4	16.5
13.5	12.3	14.6	17.1	18.6	21.9	24.9	26.7	26.1	24	21.3	15.5
13.1	15.2	15.8	14.1	18.8	23.5	25.6	26.5	27.1	24.1	21.4	17.8
14.7	15.6	16	15.9	18.9	23.8	25.1	26.9	26.4	24.3	21	17.6
15.8	15.6	16.2	15.8	20.2	23.7	24.8	26.8	26	24.3	21.5	17.7
15.6	15.9	15.4	15.5	20.6	25	24.6	27.5	26.4	24.4	21.8	17.1
16	15.5	15.6	15.9	19.9	26.1	25.3	26.7	25.5	24.1	22.1	16.6
16.5	15.3	15.2	16.3	19.5	24.1	25	25.4	25.8	24.3	21.5	16.8
15.7	15.3	13.8	17	19.1	24.5	25.4	25.1	26.2	24.7	20.9	17.9
15.6	14.5	13.5	17.7	18.7	24.7	26.4	26.1	25.8	25	20.6	17.8
15.3	13.1	15.4	18.2	17.2	24.5	27.1	25.9	26	24.1	20.7	15.1
15.6	14	15.5	18.1	17.7	24.4	27	26.1	26.3	24	20.9	15.9
15	14.2	15.9	17.2	18.4	24.4	25.7	26.3	26.5	24.2	19.9	16
15.1	13.8	16.3	17.5	18.7	24.4	25.4	26.6	26.5	24.5	20.6	16.6
15.1	15.1	15.6	19	20.3	24.4	25.9	26.4	26.4	24.5	19.6	17.2
14.3	15.6	14.9	18.2	19.1	24.9	26	26.3	25.8	24.5	19.2	15.9
13.2	15.9	15.7	18.2	19.3	24	26.2	27	25.4	21.3	19.4	16.7
13.6	15.4	16.1	18.3	19.1	25.6	26.4	26.5	25.7	21.7	19	17.7
15	14.1	16.9	18.6	19.3	25.7	26.8	26.5	24.9	21.7	19	17
13.6	13.1	16.5	17.8	19.6	24.4	28.1	26.6	24.9	22.4	18.8	16.6
13.6	14.4	16.6	16.7	19.5	24.3	26.7	26.3	25.7	22.4	18.3	15.3
14.2	14.4	16.1	17	19.8	24.2	27.8	26.6	25.3	22.3	18.1	15.9
14.5	14.1	15.7	17.6	20.1	24.4	26.7	26.5	25.2	22.2	18.8	16.4
13.7	14	15.7	17.9	19.9	24.5	26.5	27	24.7	22.7	17.5	16.9
13.4	14.6	16	18.4	20.1	24.7	26.3	26.5	22.6	22	17.5	16.5
13.9	14.8	16.8	18.5	20.9	24.8	26.5	26.4	25.3	22.1	17.9	16.7
13.3	14	18.6	18.2	21.5	24.7	27.8	25	25.2	20.7	18.3	17.3
14.5	14	16.9	17.8	21.7	25.5	27.1	26	24.7	20.7	17.7	17.3
14.7		16.7	17.4	21.7	25.3	27.1	25.1	25	20.8	17.8	16.9
14.5		16.4		21.7		27.1	25.2		20.9		16.8

2009 Effluent Temperature in °C

Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
16	13.9	12.8	16.3	19.1	23	25.2	25.8				
16	14.4	11.5	15.7	20.5	23.1	25.2	25.7				
16.1	14.7	11.6	17.1	20.5	23.4	24.1	25.6				
16	13.8	10.1	16.9	19.8	23.3	24.3	26.5				
16.4	13.5	13.2	16.9	19.7	22.5	24.3	26.6				
16.6	12.9	13.7	17.2	19	21	22.8	26.7				
14.3	14.6	15.2	16.8	19.8	21.3	23.6	26.1				
14.3	15.1	15.7	16.5	19.8	22.6	24.9	26.3				
15	15	16	17	20	23.2	23.6	25.3				
15.6	15.1	15.9	17.3	20.3	23.6	24.2	26.6				
16	15.6	15.9	17.7	20.1	23.4	23.6	26.3				
15.9	15.9	16.1	17	20	23.5	25.1	27.1				
15.7	15.7	16	16.8	20.1	23.7	24	27				
15.6	15.7	15.5	16.8	20.4	24.1	23.9	26.9				
15.4	15.6	14.1	16.4	20.9	23.2	24.6	27				
14.7	15	12.5	15.2	21.4	23.8	24.4	26.8				
14.1	14.7	13.4	17.2	21.2	23.7	24.9	26.8				
14.1	14.8	15.2	17.5	20.3	26.7	25.8	26.1				
13.9	14.5	15.9	17.9	18.1	30.7	26.3	27.2				
14.1	14.7	14.9	16.8	20.8	24.4	23.9	27.5				
13.9	14.9	15.7	18.1	21.1	24.2	23.8	27.7				
13.9	15	15.9	18.1	21.5	24.2	24.7	27.9				
14.4	14.6	15.9	18.3	21.8	24.5	24.6	26.6				
14	12.3	15.8	18.3	21.8	24.8	24.6	26.8				
14.7	13.9	15.9	18.8	21.8	24.1	25.6	26.2				
14.2	14.1	15.3	19.3	22	24	25.9	26.7				
14.6	15.1	15.1	19.7	22.3	24.9	24.9	26.9				
11.7		15.2	19.8	22.2	24.7	25.2	27				
13.2		15.7	20	22.7	24.9	25.6	25.9				
14.3		15.7	20	23.7	24.9	25.2	26.2				
14		15.9		23.2		25.4	26.4				

90th% **26.1**
10th% **14.2**

Winter (November-May) Season Effluent Temperature (degrees Celsius)																				
Nov-06	Dec-06	Jan-07	Jan-07	Mar-07	Apr-07	May-07	Nov-07	Dec-07	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09	Apr-09	May-09
20	17.8	16.6	14.1	14.1	17.6	18	21.7	19	14.4	14.5	14.2	16.6	17.9	21.2	14.7	16	13.9	12.8	16.3	19.1
20.2	17	17	14.2	14.3	18.2	18.5	20	18.1	13.8	14.7	14.5	17.6	18.3	21.4	16.5	16	14.4	11.5	15.7	20.5
19.4	16.6	14.9	13.7	16.9	17.9	17.4	21.1	18.2	13.5	12.3	14.6	17.1	18.6	21.3	15.5	16.1	14.7	11.6	17.1	20.5
17.8	14.6	15.9	14.8	16.5	17.7	17.1	19.6	17.6	13.1	15.2	15.8	14.1	18.8	21.4	17.8	16	13.8	10.1	16.9	19.8
18	13.9	16.1	13.6	13	16.1	18	20.5	17.3	14.7	15.6	16	15.9	18.9	21	17.6	16.4	13.5	13.2	16.9	19.7
17.8	13.4	16.7	13.8	13	16	17.5	20.6	16.9	15.8	15.6	16.2	15.8	20.2	21.5	17.7	16.6	12.9	13.7	17.2	19
17.5	15.6	16.3	13.2	13.2	14.7	15.1	20.1	16.7	15.6	15.9	15.4	15.5	20.6	21.8	17.1	14.3	14.6	15.2	16.8	19.8
18.3	14.7	16	13.3	13.2	14.8	16.4	19	17.1	16	15.5	15.6	15.9	19.9	22.1	16.6	14.3	15.1	15.7	16.5	19.8
19.5	13.9	15.1	13.2	13.2	15	17.7	18.5	17.5	16.5	15.3	15.2	16.3	19.5	21.5	16.8	15	15	16	17	20
19.4	14.2	15.1	13.1	13.5	16	18.3	18.8	18.4	15.7	15.3	13.8	17	19.1	20.9	17.9	15.6	15.1	15.9	17.3	20.3
22.4	15.6	14.5	12.8	13.4	15.7	19.3	19	18.3	15.6	14.5	13.5	17.7	18.7	20.6	17.8	16	15.6	15.9	17.7	20.1
21.7	16.9	15.1	12.9	13.8	16.3	17.4	19.4	18.4	15.3	13.1	15.4	18.2	17.2	20.7	15.1	15.9	15.9	16.1	17	20
16.7	16.2	14.7	14.8	15.2	16.2	15.9	20	18	15.6	14	15.5	18.1	17.7	20.9	15.9	15.7	15.7	16	16.8	20.1
17.2	15.3	15	14.9	15.3	17.2	19.1	20.5	17.2	15	14.2	15.9	17.2	18.4	19.9	16	15.6	15.7	15.5	16.8	20.4
17	15.5	16.7	13.4	19.2	16.7	19.3	20.8	15.2	15.1	13.8	16.3	17.5	18.7	20.6	16.6	15.4	15.6	14.1	16.4	20.9
20.2	16.5	16.9	13.6	15.4	15.7	20.3	18	13.6	15.1	15.1	15.6	19	20.3	19.6	17.2	14.7	15	12.5	15.2	21.4
18	15.8	14.1	13	14.9	17.4	20.1	18.3	13.6	14.3	15.6	14.9	18.2	19.1	19.2	15.9	14.1	14.7	13.4	17.2	21.2
18.5	16.9	13.7	14	14.7	15.4	18	18.7	11.4	13.2	15.9	15.7	18.2	19.3	19.4	16.7	14.1	14.8	15.2	17.5	20.3
17	16.3	13.8	13.9	13.8	16	18	17.4	14.2	13.6	15.4	16.1	18.3	19.1	19	17.7	13.9	14.5	15.9	17.9	18.1
17.2	15.3	13.2	13.3	15.1	16	19	19	15.8	15	14.1	16.9	18.6	19.3	19	17	14.1	14.7	14.9	16.8	20.8
16.5	15	12.6	13.4	14.2	17.2	19.9	20.2	15.7	13.6	13.1	16.5	17.8	19.6	18.8	16.6	13.9	14.9	15.7	18.1	21.1
12.3	14.8	12.4	14	14.8	18.8	18	19.8	15.6	13.6	14.4	16.6	16.7	19.5	18.3	15.3	13.9	15	15.9	18.1	21.5
12.2	15.7	12.5	14.1	15.6	18.6	19.9	19.4	15.6	14.2	14.4	16.1	17	19.8	18.1	15.9	14.4	14.6	15.9	18.3	21.8
14.4	17.6	14.2	13.8	15.9	18.8	24.6	19.3	15.6	14.5	14.1	15.7	17.6	20.1	18.8	16.4	14	12.3	15.8	18.3	21.8
15.2	15.1	13.5	13.5	16.2	18.5	20.9	18.1	15.5	13.7	14	15.7	17.9	19.9	17.5	16.9	14.7	13.9	15.9	18.8	21.8
15.9	15.2	14	14.7	15.7	18.5	21.6	18.4	15.6	13.4	14.6	16	18.4	20.1	17.5	16.5	14.2	14.1	15.3	19.3	22
17.4	16.3	14.1	14.9	18	18.4	21.7	19.1	12.8	13.9	14.8	16.8	18.5	20.9	17.9	16.7	14.6	15.1	15.1	19.7	22.3
16.1	15.4	13.6	13.7	17.5	18.2	21.3	18.9	13.8	13.3	14	18.6	18.2	21.5	18.3	17.3	11.7		15.2	19.8	22.2
16.5	16.2	13.3		17.7	17.8	22	18.6	15.7	14.5	14	16.9	17.8	21.7	17.7	17.3	13.2		15.7	20	22.7
18	16.1	13.7		17.9	18.1	21.9	17.7	15.1	14.7		16.7	17.4	21.7	17.8	16.9	14.3		15.7	20	23.7
	16.3	13.6		19.7		22.2		12.4	14.5		16.4		21.7		16.8	14		15.9		23.2

90th%tile	**20.1**

DMR and WET Data

Effluent Hardness Data*

Date	mg/L as CaCO3
9-May-05	83
11-May-05	90
13-May-05	86
1-Mar-06	86
3-Mar-06	89
6-Mar-06	92
30-Jan-07	82
1-Feb-07	81
3-Feb-07	80
29-Jan-08	120
31-Jan-08	107
2-Feb-08	106
17-Apr-08	84
31-Oct-08	128
3-Nov-08	128
20-Jan-09	88
22-Jan-09	88
24-Jan-09	90
Average	**95**

*obtained from 2005 permit cycle WET Tests and 2010 permit application

DMR Data October 2006 - October 2009

Date	pH Minimum (S.U.)	pH Maximum (S.U.)	DO Minimum (mg/L)	TP Average (mg/L)	TN Average (mg/L)	NH_3 Maximum (mg/L)	$cBOD_5$ Maximum (mg/L)	TSS Maximum (mg/L)	E.coli Maximum (N/100 mL)
10-Oct-06	6.5	7.4	5.6	0.9	16.8	3.3	4.1	5	32
10-Nov-06	6.3	7.4	6.1	1.4	16.1	1.2	3.1	4	1
10-Dec-06	6.4	8	6.5	1.2	17.1	2.9	2.9	3.6	17
10-Jan-07	6.5	8.3	7.4	1.3	18.9	6.2	2.4	3.2	4
10-Feb-07	6.5	7.3	8.3	0.9	9.4	2	5.2	10.3	23
10-Mar-07	6.5	7.2	7.1	0.9	12.2	1.7	7.6	15.6	1400
10-Apr-07	6	7.2	7.6	0.9	11.8	2.3	4.6	9.3	4
10-May-07	6	6.9	6.9	1.3	14	2.1	2.6	3.3	12
10-Jun-07	6.1	7.1	6.4	1.3	13.2	2.4	2.6	2	2
10-Jul-07	5.7	7.1	7.1	1.9	16	1.1	2.6	10	345
10-Aug-07	8.7	7	7.2	1.5	14.6	0.7	2.4	2	2420
10-Sep-07	6.1	6.8	7.1	1.5	12.7	0.3	2.1	1	55
10-Oct-07	5.2	7.6	7.2	1.9	16.2	1.7	3.5	3	45
10-Nov-07	6.4	7.2	7.2	1.9	16.5	0.6	2	1	21
10-Dec-07	6.2	7.2	8	1.2	15.5	0.4	2.5	1.1	20
10-Jan-08	6.4	7.3	8.5	0.8	13	1.1	2.1	1.4	32
10-Feb-08	6.1	7	6.9	1	17.7	2.2	2.2	2.4	42
10-Mar-08	6.1	7	7.3	0.7	18.1	3	3	1.7	23
10-Apr-08	4.2	6.8	8.9	0.8	19	3.1	3.3	1.6	24
10-May-08	5.7	6.7	8	0.6	13.1	1.4	2	1.4	28
10-Jun-08	6.1	6.7	7.9	0.7	14.5	3.3	2.3	1.3	37
10-Jul-08	5.8	7	7.3	1	13.5	1.3	2.1	2	365
10-Aug-08	6.1	7.1	7.4	0.8	15	0.3	2	1	68
10-Sep-08	6.4	6.9	7.2	0.8	16.6	0.5	2	1	38
10-Oct-08	5.9	6.9	7.5	0.8	15.1	0.3	2	1	579
10-Nov-08	6.3	7	7.4	0.8	13.9	0.3	2.4	1	41
10-Dec-08	6	7.5	8.2	0.6	15.1	7	2.6	1.4	70
10-Jan-09	6.3	7.4	8.7	0.6	14	1.7	3.2	1.3	40
10-Feb-09	6.1	6.8	9	0.6	16.2	2.3	2.9	1.1	21
10-Mar-09	6.1	6.8	8.6	0.6	15	4.6	3.4	7	7
10-Apr-09	6.1	6.6	8.3	0.4	13.8	1.7	2.8	4.7	60
10-May-09	3.9	6.5	8.1	0.6	14.4	0.6	2.7	3.1	71
10-Jun-09	4.3	6.8	7.8	0.6	2	1	2.4	2.4	411
10-Jul-09	5	7.2	7.3	0.6	15.5	0.7	2.5	1	2420
10-Aug-09	6.1	7.2	7.4	0.9	14.9	0.4	3.6	2	20
10-Sep-09	6.5	7.2	6.8	1	15.9	0.2	2.6	4	130
10-Oct-09	6.3	7.4	7.6	0.8	14.7	0.3	2.5	2	142
Average	**6.0**	**7.1**	**7.5**	**1.0**	**14.6**	**1.8**	**2.9**	**3.2**	**245**
90th%	**6.5**	**7.4**	**8.5**	**1.5**	**17.3**	**3.3**	**3.8**	**7.9**	**478**
10th%	**5.1**	**6.8**	**6.7**	**0.6**	**12.5**	**0.3**	**2.0**	**1.0**	**6**

Attachment F

CORMIX Model Approval Memorandum

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY

Water Division - Office of Water Permit Support
629 East Main Street Richmond, Virginia 23219

M E M O R A N D U M

Subject: Richmond Mixing

To: A. Brockenbrough, PRO

From: M. Dale Phillips, OWPS

Date: August 29, 1996

Copies:

I have applied the CORMIX model to the Richmond discharge with the following results:

1. CORMIX would not run with parameters that properly specify the discharge velocity (some sort of domain error or bug in the code). The maximum I could get it to run with is about 2.4 ft/sec. This will not invalidate the model but the results will be somewhat conservative e.g. mixing will be faster than predicted.

2. CORMIX III will not accept a discharge temperature that is less than the ambient. This will not invalidate the model but the results will be somewhat inflated (e.g. mixing will be slower that predicted because there is a potential for stratification that is not captured by the model).

3. Due to the location being very near the fall line and the lack of actual flow reversal due to the tide, I did not include any tidal mixing in the model runs.

3. The 3 items above will offset each other to some extent and I believe the attached prediction file is adequate to assess potential mixing at the Richmond outfall.

4. Due to these difficulties, I did not make any attempt to analyze any minor differences in stream flow. In my opinion, relatively small changes in the river flow is not going to make a significant difference in the mixing prediction.

5. According to the model prediction, about 2 hours travel time is required for the effluent to become fully mixed with the receiving stream. A mix with about 1/2 of the stream flow will provide an exposure time of about 1 hour.

6. According to the model prediction, the effluent is completely mixed with the stream at a distance of about 650 meters downstream from the discharge point.

Comments:

There are three conditions that make this situation difficult to analyze with a theoretical model without field data:

1. The effluent is negatively buoyant.
2. The location very near the fall line and is influenced by the tide but no flow reversal takes place.
3. The design of the foam reducing outfall structure makes estimation of the actual velocity somewhat difficult.

If stringent effluent limits result, I would suggest that you Make the city aware that a dye study may result in different results, I cannot estimate if they would be less or more stringent than the recommendations I will make. The installation of a relatively simple diffuser would result in rapid mixing at this location and should be much less expensive than installing additional treatment. I would estimate the acute WLA would approximately double with the installation of a diffuser.

Recommendations:

Based on the concepts expressed in Amendment No.1 - Mixing Zones to guidance memorandum #93-015, I would recommend:

1. Assume a complete mix of the effluent with the 7Q10 stream flow for the estimation of wasteload allocations based on chronic toxicity. The assumed condition should be reached in about 2 hours, well within the allowed 2 day exposure time.

2. Assume a complete mix of the effluent with 1/2 of the 1Q10 stream flow for the estimation of wasteload allocations based on acute toxicity. This should limit exposures to concentrations higher than the acute standards to one hour or less.

Attachment G

Effluent Limitation Analysis

Source of MIX.exe and MSTRANTI Input Data

Stream Information: 2-JMS110.30	
Stream Flows	Flow Frequency Memorandum (Attachment C). The annual 1Q10 and 30Q10 are also input as the wet season 1Q10 and 30Q10 because the seasonal tiering is based on temperature rather than flow.
Mean Hardness	Ambient Monitoring Station data (Attachment C)
90% Temperature (Annual)	
90% Temperature (Wet Season)	
90% Maximum pH	
10% Maximum pH	
Tier Designation	Flow Frequency Memorandum (Attachment C)
Mixing Information for MSTRANTI	
All Data	CORMIX model (Attachment F)
Effluent Information	
Mean Hardness	Application Effluent Data (Attachment E)
90% Temperature (Annual)	
90% Temperature (Wet Season)	
90% Maximum pH	DMR Data (See Attachment E)
10% Maximum pH	
Discharge Flow	Design Dry-weather Flow

FRESHWATER
WATER QUALITY CRITERIA / WASTELOAD ALLOCATION ANALYSIS

Facility Name: Richmond WWTP Permit No.: VA0063177

Receiving Stream: James River Version: OWP Guidance Memo 00-2011 (8/24/00)

Stream Information			Stream Flows			Mixing Information			Effluent Information		
Mean Hardness (as CaCO3) =	79	mg/L	1Q10 (Annual) =	300	MGD	Annual - 1Q10 Mix =	50	%	Mean Hardness (as CaCO3) =	95	mg/L
90% Temperature (Annual) =	28.6	deg C	7Q10 (Annual) =	355	MGD	- 7Q10 Mix =	100	%	90% Temp (Annual) =	26.1	deg C
90% Temperature (Wet season) =	20.1	deg C	30Q10 (Annual) =	496	MGD	- 30Q10 Mix =	100	%	90% Temp (Wet season) =		deg C
90% Maximum pH =	8.7	SU	1Q10 (Wet season) =	300	MGD	Wet Season - 1Q10 Mix =	50	%	90% Maximum pH =	7.4	SU
10% Maximum pH =	7.1	SU	30Q10 (Wet season)	496	MGD	- 30Q10 Mix =	100	%	10% Maximum pH =	6.8	SU
Tier Designation (1 or 2) =	1		30Q5 =	567	MGD				Discharge Flow =	45	MGD
Public Water Supply (PWS) Y/N? =	n		Harmonic Mean =	1962	MGD						
Trout Present Y/N? =	n										
Early Life Stages Present Y/N? =	y										

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				**Most Limiting Allocations**			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	**Acute**	**Chronic**	**HH (PWS)**	**HH**
Acenapthene	0	--	--	na	9.9E+02	--	--	na	1.3E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.3E+04**
Acrolein	0	--	--	na	9.3E+00	--	--	na	1.3E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.3E+02**
Acrylonitrile[C]	0	--	--	na	2.5E+00	--	--	na	1.1E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.1E+02**
Aldrin [C]	0	3.0E+00	--	na	5.0E-04	1.3E+01	--	na	2.2E-02	--	--	--	--	--	--	--	--	**1.3E+01**	**--**	**na**	**2.2E-02**
Ammonia-N (mg/l) (Yearly)	0	8.90E+00	6.34E-01	na	--	3.9E+01	7.6E+00	na	--	--	--	--	--	--	--	--	--	**3.9E+01**	**7.6E+00**	**na**	**--**
Ammonia-N (mg/l) (High Flow)	0	8.90E+00	1.21E+00	na	--	3.9E+01	1.5E+01	na	--	--	--	--	--	--	--	--	--	**3.9E+01**	**1.5E+01**	**na**	**--**
Anthracene	0	--	--	na	4.0E+04	--	--	na	5.4E+05	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**5.4E+05**
Antimony	0	--	--	na	6.4E+02	--	--	na	8.7E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.7E+03**
Arsenic	o	3.4E+02	1.5E+02	na	--	1.5E+03	1.3E+03	na	--	--	--	--	--	--	--	--	--	**1.5E+03**	**1.3E+03**	**na**	**--**
Barium	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Benzene [C]	0	--	--	na	5.1E+02	--	--	na	2.3E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.3E+04**
Benzidine[C]	0	--	--	na	2.0E-03	--	--	na	8.9E-02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.9E-02**
Benzo (a) anthracene [C]	0	--	--	na	1.8E-01	--	--	na	8.0E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.0E+00**
Benzo (b) fluoranthene [C]	0	--	--	na	1.8E-01	--	--	na	8.0E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.0E+00**
Benzo (k) fluoranthene [C]	0	--	--	na	1.8E-01	--	--	na	8.0E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.0E+00**
Benzo (a) pyrene [C]	0	--	--	na	1.8E-01	--	--	na	8.0E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.0E+00**
Bis2-Chloroethyl Ether [C]	0	--	--	na	5.3E+00	--	--	na	2.4E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.4E+02**
Bis2-Chloroisopropyl Ether	0	--	--	na	6.5E+04	--	--	na	8.8E+05	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.8E+05**
Bis 2-Ethylhexyl Phthalate [C]	0	--	--	na	2.2E+01	--	--	na	9.8E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**9.8E+02**
Bromoform [C]	0	--	--	na	1.4E+03	--	--	na	6.2E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**6.2E+04**
Butylbenzylphthalate	0	--	--	na	1.9E+03	--	--	na	2.6E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.6E+04**
Cadmium	0	3.2E+00	9.6E-01	na	--	1.4E+01	8.5E+00	na	--	--	--	--	--	--	--	--	--	**1.4E+01**	**8.5E+00**	**na**	**--**
Carbon Tetrachloride [C]	0	--	--	na	1.6E+01	--	--	na	7.1E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**7.1E+02**
Chlordane [C]	0	2.4E+00	4.3E-03	na	8.1E-03	1.0E+01	3.8E-02	na	3.6E-01	--	--	--	--	--	--	--	--	**1.0E+01**	**3.8E-02**	**na**	**3.6E-01**
Chloride	0	8.6E+05	2.3E+05	na	--	3.7E+06	2.0E+06	na	--	--	--	--	--	--	--	--	--	**3.7E+06**	**2.0E+06**	**na**	**--**
TRC	0	1.9E+01	1.1E+01	na	--	8.2E+01	9.8E+01	na	--	--	--	--	--	--	--	--	--	**8.2E+01**	**9.8E+01**	**na**	**--**
Chlorobenzene	0	--	--	na	1.6E+03	--	--	na	2.2E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.2E+04**

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				**Most Limiting Allocations**			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	**Acute**	**Chronic**	**HH (PWS)**	**HH**
Chlorodibromomethane[C]	0	--	--	na	1.3E+02	--	--	na	5.8E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**5.8E+03**
Chloroform	0	--	--	na	1.1E+04	--	--	na	1.5E+05	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.5E+05**
2-Chloronaphthalene	0	--	--	na	1.6E+03	--	--	na	2.2E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.2E+04**
2-Chlorophenol	0	--	--	na	1.5E+02	--	--	na	2.0E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.0E+03**
Chlorpyrifos	0	8.3E-02	4.1E-02	na	--	3.6E-01	3.6E-01	na	--	--	--	--	--	--	--	--	--	**3.6E-01**	**3.6E-01**	**na**	**--**
Chromium III	0	4.9E+02	6.2E+01	na	--	2.1E+03	5.5E+02	na	--	--	--	--	--	--	--	--	--	**2.1E+03**	**5.5E+02**	**na**	**--**
Chromium VI	0	1.6E+01	1.1E+01	na	--	6.9E+01	9.8E+01	na	--	--	--	--	--	--	--	--	--	**6.9E+01**	**9.8E+01**	**na**	**--**
Chromium, Total	0	--	--	1.0E+02	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Chrysene [C]	0	--	--	na	1.8E-02	--	--	na	8.0E-01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.0E-01**
Copper	0	1.1E+01	7.5E+00	na	--	4.9E+01	6.6E+01	na	--	--	--	--	--	--	--	--	--	**4.9E+01**	**6.6E+01**	**na**	**--**
Cyanide, Free	0	2.2E+01	5.2E+00	na	1.6E+04	9.5E+01	4.6E+01	na	2.2E+05	--	--	--	--	--	--	--	--	**9.5E+01**	**4.6E+01**	**na**	**2.2E+05**
DDD [C]	0	--	--	na	3.1E-03	--	--	na	1.4E-01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.4E-01**
DDE [C]	0	--	--	na	2.2E-03	--	--	na	9.8E-02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**9.8E-02**
DDT [C]	0	1.1E+00	1.0E-03	na	2.2E-03	4.8E+00	8.9E-03	na	9.8E-02	--	--	--	--	--	--	--	--	**4.8E+00**	**8.9E-03**	**na**	**9.8E-02**
Demeton	0	--	1.0E-01	na	--	--	8.9E-01	na	--	--	--	--	--	--	--	--	--	**--**	**8.9E-01**	**na**	**--**
Diazinon	0	1.7E-01	1.7E-01	na	--	7.4E-01	1.5E+00	na	--	--	--	--	--	--	--	--	--	**7.4E-01**	**1.5E+00**	**na**	**--**
Dibenz(a,h)anthracene [C]	0	--	--	na	1.8E-01	--	--	na	8.0E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.0E+00**
1,2-Dichlorobenzene	0	--	--	na	1.3E+03	--	--	na	1.8E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.8E+04**
1,3-Dichlorobenzene	0	--	--	na	9.6E+02	--	--	na	1.3E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.3E+04**
1,4-Dichlorobenzene	0	--	--	na	1.9E+02	--	--	na	2.6E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.6E+03**
3,3-Dichlorobenzidine[C]	0	--	--	na	2.8E-01	--	--	na	1.2E+01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.2E+01**
Dichlorobromomethane [C]	0	--	--	na	1.7E+02	--	--	na	7.6E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**7.6E+03**
1,2-Dichloroethane [C]	0	--	--	na	3.7E+02	--	--	na	1.7E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.7E+04**
1,1-Dichloroethylene	0	--	--	na	7.1E+03	--	--	na	9.7E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**9.7E+04**
1,2-trans-dichloroethylene	0	--	--	na	1.0E+04	--	--	na	1.4E+05	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.4E+05**
2,4-Dichlorophenol	0	--	--	na	2.9E+02	--	--	na	3.9E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**3.9E+03**
2,4-Dichlorophenoxy acetic acid (2,4-D)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
1,2-Dichloropropane[C]	0	--	--	na	1.5E+02	--	--	na	6.7E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**6.7E+03**
1,3-Dichloropropene [C]	0	--	--	na	2.1E+02	--	--	na	9.4E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**9.4E+03**
Dieldrin [C]	0	2.4E-01	5.6E-02	na	5.4E-04	1.0E+00	5.0E-01	na	2.4E-02	--	--	--	--	--	--	--	--	**1.0E+00**	**5.0E-01**	**na**	**2.4E-02**
Diethyl Phthalate	0	--	--	na	4.4E+04	--	--	na	6.0E+05	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**6.0E+05**
2,4-Dimethylphenol	0	--	--	na	8.5E+02	--	--	na	1.2E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.2E+04**
Dimethyl Phthalate	0	--	--	na	1.1E+06	--	--	na	1.5E+07	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.5E+07**
Di-n-Butyl Phthalate	0	--	--	na	4.5E+03	--	--	na	6.1E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**6.1E+04**
2,4 Dinitrophenol	0	--	--	na	5.3E+03	--	--	na	7.2E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**7.2E+04**
2-Methyl-4,6-Dinitrophenol	0	--	--	na	2.8E+02	--	--	na	3.8E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**3.8E+03**
2,4-Dinitrotoluene [C]	0	--	--	na	3.4E+01	--	--	na	1.5E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.5E+03**
Dioxin 2,3,7,8-tetrachlorodibenzo-p-dioxin	0	--	--	na	5.1E-08	--	--	na	6.9E-07	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**6.9E-07**
1,2-Diphenylhydrazine[C]	0	--	--	na	2.0E+00	--	--	na	8.9E+01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.9E+01**
Alpha-Endosulfan	0	2.2E-01	5.6E-02	na	8.9E+01	9.5E-01	5.0E-01	na	1.2E+03	--	--	--	--	--	--	--	--	**9.5E-01**	**5.0E-01**	**na**	**1.2E+03**
Beta-Endosulfan	0	2.2E-01	5.6E-02	na	8.9E+01	9.5E-01	5.0E-01	na	1.2E+03	--	--	--	--	--	--	--	--	**9.5E-01**	**5.0E-01**	**na**	**1.2E+03**
Alpha + Beta Endosulfan	0	2.2E-01	5.6E-02	--	--	9.5E-01	5.0E-01	--	--	--	--	--	--	--	--	--	--	**9.5E-01**	**5.0E-01**	**--**	**--**
Endosulfan Sulfate	0	--	--	na	8.9E+01	--	--	na	1.2E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.2E+03**
Endrin	0	8.6E-02	3.6E-02	na	6.0E-02	3.7E-01	3.2E-01	na	8.2E-01	--	--	--	--	--	--	--	--	**3.7E-01**	**3.2E-01**	**na**	**8.2E-01**
Endrin Aldehyde	0	--	--	na	3.0E-01	--	--	na	4.1E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**4.1E+00**

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				**Most Limiting Allocations**			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	**Acute**	**Chronic**	**HH (PWS)**	**HH**
Ethylbenzene	0	--	--	na	2.1E+03	--	--	na	2.9E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.9E+04**
Fluoranthene	0	--	--	na	1.4E+02	--	--	na	1.9E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.9E+03**
Fluorene	0	--	--	na	5.3E+03	--	--	na	7.2E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**7.2E+04**
Foaming Agents	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Guthion	0	--	1.0E-02	na	--	--	8.9E-02	na	--	--	--	--	--	--	--	--	--	**--**	**8.9E-02**	**na**	**--**
Heptachlor [C]	0	5.2E-01	3.8E-03	na	7.9E-04	2.3E+00	3.4E-02	na	3.5E-02	--	--	--	--	--	--	--	--	**2.3E+00**	**3.4E-02**	**na**	**3.5E-02**
Heptachlor Epoxide[C]	0	5.2E-01	3.8E-03	na	3.9E-04	2.3E+00	3.4E-02	na	1.7E-02	--	--	--	--	--	--	--	--	**2.3E+00**	**3.4E-02**	**na**	**1.7E-02**
Hexachlorobenzene[C]	0	--	--	na	2.9E-03	--	--	na	1.3E-01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.3E-01**
Hexachlorobutadiene[C]	0	--	--	na	1.8E+02	--	--	na	8.0E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.0E+03**
Hexachlorocyclohexane Alpha-BHC[C]	0	--	--	na	4.9E-02	--	--	na	2.2E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.2E+00**
Hexachlorocyclohexane Beta-BHC[C]	0	--	--	na	1.7E-01	--	--	na	7.6E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**7.6E+00**
Hexachlorocyclohexane Gamma-BHC[C] (Lindane)	0	9.5E-01	na	na	1.8E+00	4.1E+00	--	na	8.0E+01	--	--	--	--	--	--	--	--	**4.1E+00**	**--**	**na**	**8.0E+01**
Hexachlorocyclopentadiene	0	--	--	na	1.1E+03	--	--	na	1.5E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.5E+04**
Hexachloroethane[C]	0	--	--	na	3.3E+01	--	--	na	1.5E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.5E+03**
Hydrogen Sulfide	0	--	2.0E+00	na	--	--	1.8E+01	na	--	--	--	--	--	--	--	--	--	**--**	**1.8E+01**	**na**	**--**
Indeno (1,2,3-cd) pyrene [C]	0	--	--	na	1.8E-01	--	--	na	8.0E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.0E+00**
Iron	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Isophorone[C]	0	--	--	na	9.6E+03	--	--	na	4.3E+05	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**4.3E+05**
Kepone	0	--	0.0E+00	na	--	--	0.0E+00	na	--	--	--	--	--	--	--	--	--	**--**	**0.0E+00**	**na**	**--**
Lead	0	9.3E+01	1.0E+01	na	--	4.0E+02	9.2E+01	na	--	--	--	--	--	--	--	--	--	**4.0E+02**	**9.2E+01**	**na**	**--**
Malathion	0	--	1.0E-01	na	--	--	8.9E-01	na	--	--	--	--	--	--	--	--	--	**--**	**8.9E-01**	**na**	**--**
Manganese	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Mercury	0	1.4E+00	7.7E-01	- -	- -	6.1E+00	6.8E+00	- -	- -	--	--	--	--	--	--	--	--	**6.1E+00**	**6.8E+00**	**- -**	**- -**
Methyl Bromide	0	--	--	na	1.5E+03	--	--	na	2.0E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.0E+04**
Methylene Chloride [C]	0	--	--	na	5.9E+03	--	--	na	2.6E+05	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.6E+05**
Methoxychlor	0	--	3.0E-02	na	--	--	2.7E-01	na	--	--	--	--	--	--	--	--	--	**--**	**2.7E-01**	**na**	**--**
Mirex	0	--	0.0E+00	na	--	--	0.0E+00	na	--	--	--	--	--	--	--	--	--	**--**	**0.0E+00**	**na**	**--**
Nickel	0	1.6E+02	1.7E+01	na	4.6E+03	6.7E+02	1.5E+02	na	6.3E+04	--	--	--	--	--	--	--	--	**6.7E+02**	**1.5E+02**	**na**	**6.3E+04**
Nitrate (as N)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Nitrobenzene	0	--	--	na	6.9E+02	--	--	na	9.4E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**9.4E+03**
N-Nitrosodimethylamine[C]	0	--	--	na	3.0E+01	--	--	na	1.3E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.3E+03**
N-Nitrosodiphenylamine[C]	0	--	--	na	6.0E+01	--	--	na	2.7E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.7E+03**
N-Nitrosodi-n-propylamine[C]	0	--	--	na	5.1E+00	--	--	na	2.3E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**2.3E+02**
Nonylphenol	0	2.8E+01	6.6E+00	--	--	1.2E+02	5.9E+01	na	--	--	--	--	--	--	--	--	--	**1.2E+02**	**5.9E+01**	**na**	**--**
Parathion	0	6.5E-02	1.3E-02	na	--	2.8E-01	1.2E-01	na	--	--	--	--	--	--	--	--	--	**2.8E-01**	**1.2E-01**	**na**	**--**
PCB Total[C]	0	--	1.4E-02	na	6.4E-04	--	1.2E-01	na	2.9E-02	--	--	--	--	--	--	--	--	**--**	**1.2E-01**	**na**	**2.9E-02**
Pentachlorophenol [C]	0	8.8E+00	7.1E+00	na	3.0E+01	3.8E+01	6.3E+01	na	1.3E+03	--	--	--	--	--	--	--	--	**3.8E+01**	**6.3E+01**	**na**	**1.3E+03**
Phenol	0	--	--	na	8.6E+05	--	--	na	1.2E+07	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.2E+07**
Pyrene	0	--	--	na	4.0E+03	--	--	na	5.4E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**5.4E+04**
Radionuclides	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Gross Alpha Activity (pCi/L)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Beta and Photon Activity (mrem/yr)	0	--	--	na	4.0E+00	--	--	na	5.4E+01	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**5.4E+01**
Radium 226 + 228 (pCi/L)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Uranium (ug/l)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**

Parameter	Background	Water Quality Criteria				Wasteload Allocations				Antidegradation Baseline				Antidegradation Allocations				**Most Limiting Allocations**			
(ug/l unless noted)	Conc.	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	Acute	Chronic	HH (PWS)	HH	**Acute**	**Chronic**	**HH (PWS)**	**HH**
Selenium, Total Recoverable	0	2.0E+01	5.0E+00	na	4.2E+03	8.7E+01	4.4E+01	na	5.7E+04	--	--	--	--	--	--	--	--	**8.7E+01**	**4.4E+01**	**na**	**5.7E+04**
Silver	0	2.5E+00	--	na	--	1.1E+01	--	na	--	--	--	--	--	--	--	--	--	**1.1E+01**	**--**	**na**	**--**
Sulfate	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
1,1,2,2-Tetrachloroethane[C]	0	--	--	na	4.0E+01	--	--	na	1.8E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.8E+03**
Tetrachloroethylene[C]	0	--	--	na	3.3E+01	--	--	na	1.5E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.5E+03**
Thallium	0	--	--	na	4.7E-01	--	--	na	6.4E+00	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**6.4E+00**
Toluene	0	--	--	na	6.0E+03	--	--	na	8.2E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**8.2E+04**
Total dissolved solids	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Toxaphene [C]	0	7.3E-01	2.0E-04	na	2.8E-03	3.2E+00	1.8E-03	na	1.2E-01	--	--	--	--	--	--	--	--	**3.2E+00**	**1.8E-03**	**na**	**1.2E-01**
Tributyltin	0	4.6E-01	7.2E-02	na	--	2.0E+00	6.4E-01	na	--	--	--	--	--	--	--	--	--	**2.0E+00**	**6.4E-01**	**na**	**--**
1,2,4-Trichlorobenzene	0	--	--	na	7.0E+01	--	--	na	9.5E+02	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**9.5E+02**
1,1,2-Trichloroethane[C]	0	--	--	na	1.6E+02	--	--	na	7.1E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**7.1E+03**
Trichloroethylene [C]	0	--	--	na	3.0E+02	--	--	na	1.3E+04	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.3E+04**
2,4,6-Trichlorophenol [C]	0	--	--	na	2.4E+01	--	--	na	1.1E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.1E+03**
2-(2,4,5-Trichlorophenoxy) propionic acid (Silvex)	0	--	--	na	--	--	--	na	--	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**--**
Vinyl Chloride[C]	0	--	--	na	2.4E+01	--	--	na	1.1E+03	--	--	--	--	--	--	--	--	**--**	**--**	**na**	**1.1E+03**
Zinc	0	1.0E+02	9.9E+01	na	2.6E+04	4.3E+02	8.8E+02	na	3.5E+05	--	--	--	--	--	--	--	--	**4.3E+02**	**8.8E+02**	**na**	**3.5E+05**

Notes:

1. All concentrations expressed as micrograms/liter (ug/l), unless noted otherwise
2. Discharge flow is highest monthly average or Form 2C maximum for Industries and design flow for Municipals
3. Metals measured as Dissolved, unless specified otherwise
4. "C" indicates a carcinogenic parameter
5. Regular WLAs are mass balances (minus background concentration) using the % of stream flow entered above under Mixing Information.
   Antidegradation WLAs are based upon a complete mix.
6. Antideg. Baseline = (0.25(WQC - background conc.) + background conc.) for acute and chronic
   = (0.1(WQC - background conc.) + background conc.) for human health
7. WLAs established at the following stream flows: 1Q10 for Acute, 30Q10 for Chronic Ammonia, 7Q10 for Other Chronic, 30Q5 for Non-carcinogens and Harmonic Mean for Carcinogens. To apply mixing ratios from a model set the stream flow equal to (mixing ratio - 1), effluent flow equal to 1 and 100% mix.

Metal	Target Value (SSTV)
Antimony	8.7E+03
Arsenic	5.9E+02
Barium	na
Cadmium	5.1E+00
Chromium III	3.3E+02
Chromium VI	2.8E+01
Copper	1.9E+01
Iron	na
Lead	5.5E+01
Manganese	na
Mercury	2.4E+00
Nickel	9.0E+01
Selenium	2.7E+01
Silver	4.3E+00
Zinc	1.7E+02

Note: do not use QL's lower than the minimum QL's provided in agency guidance

Chloride

Facility = CoR
Chemical = Chloride
Chronic averaging period = 4
WLAa = 3700
WLAc = 2000
Q.L. = 1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:
observations = 1
Expected Value = 48
Variance = 829.44
C.V. = 0.6
97th percentile daily values = 116.804
97th percentile 4 day average = 79.8619
97th percentile 30 day average= 57.8905
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

No Limit is required for this material

The data are:
48

Zinc

Facility = CoR
Chemical = Zinc
Chronic averaging period = 4
WLAa = 430
WLAc = 880
Q.L. = 5
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:
observations = 3
Expected Value = 44.3333
Variance = 707.56
C.V. = 0.6
97th percentile daily values = 107.881
97th percentile 4 day average = 73.7613
97th percentile 30 day average= 53.4683
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

No Limit is required for this material

The data are:
50
41
42

Note: All effluent data above was submitted in the permit application. Chloride is expressed in mg/L and zinc is expressed in µg/L. As indicated, no limitations are needed for chloride or zinc at this time.

TRC

Facility = CoR
Chemical = TRC
Chronic averaging period = 4
WLAa = 82
WLAc = 98
Q.L. = 1
# samples/mo. = 360
# samples/wk. = 90

Summary of Statistics:
observations = 1
Expected Value = 20000
Variance = 1440000
C.V. = 0.6
97th percentile daily values = 48668.3
97th percentile 4 day average = 33275.8
97th percentile 30 day average= 24121.0
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

A limit is needed based on Acute Toxicity
Maximum Daily Limit = 82
Average Weekly limit = 37.8742990225253
Average Monthly LImit = 35.7018717094059

The data are:
20000

Note: 20000 µg/L was used to force a limitation per Guidance Memorandum 00-2011. As indicated, the TRC weekly average limit is 38 µg/L; the TRC monthly average limit is 36 µg/L.

Ammonia (June – October)

Facility = CoR
Chemical = NH3
Chronic averaging period = 30
WLAa = 39
WLAc = 7.6
Q.L. = 0.2
# samples/mo. = 30
# samples/wk. = 7

Summary of Statistics:
observations = 1
Expected Value = 9
Variance = 29.16
C.V. = 0.6
97th percentile daily values = 21.9007
97th percentile 4 day average = 14.9741
97th percentile 30 day average= 10.8544
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

A limit is needed based on Chronic Toxicity
Maximum Daily Limit = 15.334292709964
Average Weekly limit = 9.36476306842008
Average Monthly LImit = 7.60

The data are:
9.00

Note: 9.00 mg/L was used to force a limitation per Guidance Memorandum 00-2011. As indicated, water quality-base effluent limitations are necessary. However, antibacksliding also prohibits the relaxation of limitations. Discussion of the permit limits is found in Item 18 of the fact sheet.

Ammonia (November - May)

Facility = CoR
Chemical = NH3
Chronic averaging period = 30
WLAa = 39
WLAc = 15
Q.L. = 0.2
# samples/mo. = 30
# samples/wk. = 7

Summary of Statistics:
observations = 1
Expected Value = 9
Variance = 29.16
C.V. = 0.6
97th percentile daily values = 21.9007
97th percentile 4 day average = 14.9741
97th percentile 30 day average= 10.8544
< Q.L. = 0
Model used = BPJ Assumptions, type 2 data

No Limit is required for this material

The data are:
9.00

Note: 9.00 mg/L was used to force a limitation per Guidance Memorandum 00-2011. As indicated, water quality-base effluent limitations are not necessary. Discussion of the permit limits is found in Item 18 of the fact sheet.

Cadmium

Facility = CoR
Chemical = Cd
Chronic averaging period = 4
WLAa = 14
WLAc = 8.5
Q.L. = .1
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:
observations = 3
Expected Value = .092774
Variance = .003098
C.V. = 0.6
97th percentile daily values = .225760
97th percentile 4 day average = .154357
97th percentile 30 day average= .111891
< Q.L. = 2
Model used = BPJ Assumptions, Type 1 data

No Limit is required for this material

The data are:
0.13
0
0

Copper

Facility = CoR
Chemical = Cu
Chronic averaging period = 4
WLAa = 49
WLAc = 66
Q.L. = 5
# samples/mo. = 1
# samples/wk. = 1

Summary of Statistics:
observations = 3
Expected Value = 7.44178
Variance = 19.9368
C.V. = 0.6
97th percentile daily values = 18.1089
97th percentile 4 day average = 12.3815
97th percentile 30 day average= 8.97518
< Q.L. = 1
Model used = BPJ Assumptions, Type 1 data

No Limit is required for this material

The data are:
5
0
8

Note: All effluent data above was submitted in the permit application and are expressed in µg/L. Data entered as "<QL" are represented as "0." As indicated, no limitations are needed for either metal at this time.

Attachment H

Richmond Crater Water Quality Management Plan

Allied (Hopewell)	165.00	2750		10326		6.1		2750		10326		6.1
Hopewell Regional WTF	34.07	12502	44.0	12091	36.2	4.8		12502	44.0	10291	36.2	4.8
Petersburg STP	15.00	2802	22.4	801	6.4	5.0		2802	22.4	2028	16.2	5.0
TOTAL	380.81	31084		28978				36679	35958			

1 NH3-N values represent ammonia as nitrogen.

2 Dissolved oxygen limits represent average minimum allowable levels.

3 Allied (Hopewell) allocation may be redistributed to the Hopewell Regional WTF by VPDES permit.

TABLE B7- WASTE LOAD ALLOCATION FOR THE YEAR 2000

	SUMMER (June-October)							WINTER (November-May)				
	FLOW (mgd)	CBOD5		NH3-N1,3		DO2 (mg/l)		CBOD5		NH3-N1		DO2 (mg/l)
		(lbs/d)	(mg/l)	(lbs/d)	(mg/l)			(lbs/d)	(mg/l)	(lbs/d)	(mg/l)	
City of Richmond STP	45.08	3002	8.0	2403	6.4	5.6		5367	14.3	5707	15.2	5.6
E.I. DuPont-Spruance	196.99	948		590		4.4		948		756		2.9
Falling Creek STP	10.10	1348	16.0	539	6.4	5.9		2023	24.0	1281	15.2	5.9
Proctor's Creek STP	16.80	1602	11.4	961	6.9	5.9		2403	17.1	1402	10.0	5.9
Reynolds Metals Co.	0.78	172		13		6.5		172		13		6.5
Henrico STP	32.80	3002	11.0	2403	8.8	5.6		4756	17.4	3504	12.8	5.6
American Tobacco Co.	3.00	715		113		5.8		715		113		5.8
ICI Americas, Inc.	0.20	167		8		5.8		167		8		3.1
Phillip Morris- Park 500	2.90	819		92		4.6		819		92		4.6
Allied (Chesterfield)	56.00	1255		442		5.7		1255		442		5.7
Allied (Hopewell)	170.00	2750		10326		6.1		2750		10326		6.1
Hopewell Regional WTF	36.78	12502	40.7	12091	33.5	4.8		12502	40.7	10291	33.5	4.8
Petersburg STP	15.00	2802	22.4	801	6.4	5.0		2802	22.4	2028	16.2	5.0
TOTAL	406.43	31084		28982				36679		35963		

1 NH3-N values represent ammonia as nitrogen.

2 Dissolved oxygen limits represent average minimum allowable levels.

3 Allied (Hopewell) allocation may be redistributed to the Hopewell Regional WTF by VPDES permit.

TABLE B7- WASTE LOAD ALLOCATIONS FOR THE YEAR 2010

	SUMMER (June-October)							WINTER (November-May)				
	FLOW (mgd)	CBOD5		NH3-N1,3		DO2 (mg/l)		CBOD5		NH3-N1		DO2 (mg/l)
		(lbs/d)	(mg/l)	(lbs/d)	(mg/l)			(lbs/d)	(mg/l)	(lbs/d)	(mg/l)	
City of Richmond STP	45.86	3002	7.8	2403	6.3	5.6		5367	14.0	5707	14.9	5.6
E.I. DuPont-Spruance	16.99	948		590		4.4		948		756		2.9
Falling Creek STP	10.10	1348	16.0	539	6.4	5.9		2023	24.0	1281	15.2	5.9
Proctor's Creek STP	24.00	1602	8.0	961	4.8	5.9		2403	12.0	1402	7.0	5.9
Reynolds Metals Co.	0.78	172		13		6.5		172		13		6.5
Henrico STP	38.07	3002	9.5	2403	7.6	5.6		4756	15.0	3504	11.0	5.6
American Tobacco Co.	3.00	715		113		5.8		715		113		5.8
ICI Americas, Inc.	0.20	167		8		5.8		167		8		3.1
Phillip Morris- Park 500	2.90	819		92		4.6		819		92		4.6
Allied (Chesterfield)	56.00	1255		442		5.7		1255		442		5.7
Allied (Hopewell)	180.00	2750		10326		6.1		2750		10326		6.1
Hopewell Regional WTF	39.61	12502	37.8	10291	31.1	4.8		12502	37.8	10291	31.1	4.8
Petersburg STP	15.00	2802	22.4	801	6.4	5.0		2802	22.4	2028	16.2	5.0
TOTAL	432.1	31084		28982				36679		35963		

1 NH3-N values represent ammonia as nitrogen.

2 Dissolved oxygen limits represent average minimum allowable levels.

3 Allied (Hopewell) allocation may be redistributed to the Hopewell Regional WTF by VPDES permit.

Attachment I

WET Testing Evaluation and Memorandum

MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL QUALITY
Piedmont Regional Office

4949-A Cox Road Glen Allen, VA 23060 804/527-5020

SUBJECT: Whole Effluent Toxicity (WET) Test Data Review:
Richmond WWTP, VPDES Permit No. VA0063177

TO: Curtis J. Linderman, Water Permit Manager, PRO

FROM: Gina Kelly, PRO

DATE: November 5, 2009; revised January 21, 2010

COPIES: Deborah DeBiasi, CO - WET

Facility Name: Richmond WWTP
Permit Number: VA0063177
Receiving Stream James River (Lower) - Freshwater tidal
Facility SIC: 4952
In-stream Waste Concentration (IWC): Outfall 001: IWC $_{acute}$ 23.07%, IWC $_{chronic}$ 11.25%
Effluent Design Flow 45 MGD (dry weather flow); 75 MGD (wet weather flow)

Stream Flows	**Low Flows***	**High Flows***
1-Day, 10-Year	300 MGD	923 MGD
7-Day, 10-Year	355 MGD	1118 MGD

* These flows represent the adjusted stream flow, reflecting the water withdrawals by the Henrico and Richmond Water Treatment Plants

FACILITY DESCRIPTION
The permit for this municipal discharger is in the process of reissuance. Richmond WWTP is owned and operated by the City of Richmond; the actual facility is located at 1400 Brander St., Richmond, VA. The facility discharges treated wastewater (mostly municipal with some industrial contributors) through outfall 001 to the James River.

FACILITY REQUIREMENTS
The expiring VPDES permit contains a WET Testing Program for outfall 001; requirements of the WET tests are based on Guidance Memorandum Number 00-2012.

The expiring permit was reissued effective March 19, 2005 and included a Whole Effluent Toxicity Program special condition requiring annual monitoring for outfall 001. Required testing included acute and chronic tests using *Ceriodaphnia dubia and Pimephales promelas*; both testing scenarios required 24-hour flow-proportioned effluent samples. All toxicity tests were performed by James Reed and Associates. No quality control problems were found in any of the tests performed for the VPDES permit.

The acute tests were required to be 48-hour static tests using the two test species noted above; the acute test had an endpoint of an $LC_{50} \geq 63\%$. Static renewal chronic tests were also to be performed with these two test species; the chronic test endpoint was an NOEC $\geq 7\%$.

Results of the whole effluent toxicity tests performed on samples since the permit reissuance in 2005 indicate compliance with the WET Program in the current permit. During the permit term, all of the acute tests resulted in LC_{50}s >100% and all the chronic tests results in NOECs = 100%.

The proposed special condition language is attached. Also attached is the WETLim10 spreadsheet, which was used to compute the endpoints for acute and chronic toxicity contained in the special condition. At the bottom of page three is a recommended dilution series for the chronic tests which, if used will simplify the determination of compliance with the chronic toxicity endpoint contained in the permit.

DATA SUMMARY

Table 1: Results of **Acute Toxicity Tests** *C. dubia*

TEST DATE	TEST RESULT	% SURVIVAL IN 100% EFFLUENT	TEST LAB	COMMENTS
May 2005	LC50 > 100%	100%	James R. Reed & Associates	1, 3
March 2006	LC50 > 100%	100%	James R. Reed & Associates	1, 3
January 2007	LC50 > 100%	100%	James R. Reed & Associates	1, 3
January 2008	LC50 > 100%	100%	James R. Reed & Associates	1, 2, 3
January 2009	LC50 > 100%	100%	James R. Reed & Associates	1, 2, 3

Table 2: Results of **Acute Toxicity Tests** *P.promelas*

TEST DATE	TEST RESULT	% SURVIVAL IN 100% EFFLUENT	TEST LAB	COMMENTS
May 2005	LC50 > 100%	100%	James R. Reed & Associates	1, 3
March 2006	LC50 > 100%	100%	James R. Reed & Associates	1, 3
January 2007	LC50 > 100%	95%	James R. Reed & Associates	1, 3
January 2008	LC50 > 100%	100%	James R. Reed & Associates	1, 2, 3
January 2009	LC50 > 100%	100%	James R. Reed & Associates	1, 2, 3

Comments:

1. No notation regarding whether sample had to be filtered or not (assume “not” unless noted).
2. DO was not measured daily in one replicate at each concentration (only at 0 and 48 hours).
3. pH was not measured daily in one replicate at each concentration (only at 0 and 48 hours).

Table 3: Results of **Chronic Toxicity Tests** *C. dubia*

TEST DATE	TEST RESULT	% SURVIVAL IN 100% EFFLUENT	TEST LAB	COMMENTS
May 2005	NOEC= 100%	100%	James R. Reed & Associates	1, 2, 3
March 2006	NOEC= 100%	90%	James R. Reed & Associates	1, 2, 4
January 2007	NOEC= 100%	100%	James R. Reed & Associates	1, 2, 4
January 2008	NOEC= 100%	100%	James R. Reed & Associates	1, 5
January 2009	NOEC= 100%	100%	James R. Reed & Associates	1, 2, 4

Table 4: Results of **Chronic Toxicity Tests** *P.promelas*

TEST DATE	TEST RESULT	% SURVIVAL IN 100% EFFLUENT	TEST LAB	COMMENTS
May 2005	NOEC= 100%	100%	James R. Reed & Associates	1, 2, 3
March 2006	NOEC= 100%	100%	James R. Reed & Associates	1, 2, 4
January 2007	NOEC= 100%	100%	James R. Reed & Associates	1, 2, 4
January 2008	NOEC= 100%	100%	James R. Reed & Associates	1, 5
January 2009	NOEC= 100%	100%	James R. Reed & Associates	1, 2, 4

Comments:

1. No notation regarding whether sample had to be filtered or not (assume "not" unless noted).
2. Feeding information (what, when) during the testing was not provided.
3. Organisms were not within the specified time period for age.
4. Renewal did not occur within 24 ± 2 hrs.
5. The pH of the dilution water was outside of the suggested range of 7.4 –7.8, or 7.9- 8.3 for mineral water.

CONCLUSIONS & RECOMMENDATIONS

The results of these toxicity tests for outfall 001are summarized in the tables above. As indicated, all tests met the appropriate toxicity criterion. Thus, these annual compliance toxicity tests indicate that effluent from outfall 001 has not demonstrated acute or chronic toxicity in undiluted effluent or at instream exposures.

Given the results of the acute tests, the acute testing requirements were removed. Chronic toxicity testing with two species meets the needs of the VPDES reissuance application and other legal requirements. Accordingly, the permitting staff recommend the following Draft WET Special Condition language.

Whole Effluent Toxicity (WET) Monitoring Program

1. Biological Monitoring
   a. In accordance with the schedule in Part I.E.2 below, the permittee shall perform annual chronic toxicity testing on Outfall 001 using 24-hour flow-proportioned composite samples for the duration of the permit. The chronic tests to use are:

      Chronic 3-Brood Survival and Reproduction Static Renewal Test with *Ceriodaphnia dubia*
      Chronic 7-Day Survival and Growth Static Renewal Test with *Pimephales promelas*

      These chronic tests shall be conducted in such a manner and at sufficient dilutions (minimum of five dilutions, derived geometrically) to determine the "No Observed Effect Concentration" (NOEC) for survival and reproduction or growth. Results which cannot be quantified (i.e., a "less than" NOEC value) are not acceptable, and a retest will have to be performed. A retest of a non-acceptable test must be performed during the same compliance period as the .test it is replacing. Express the test NOEC as TUc (Chronic Toxic Units), by dividing 100/NOEC for DMR reporting. Report the LC_{50} at 48 hours and the IC_{25} with the NOEC's in the test report.

   b. The test dilutions should be able to determine compliance with the following endpoint(s):
      Outfall 001
      Chronic NOEC $\geq$ 8.0 %, equivalent to a TUc $\leq$ 12.5%

   c. The permittee may provide additional samples to address data variability. These data shall be reported and may be included in the evaluation of effluent toxicity. Test procedures and reporting shall be in accordance with the WET testing methods cited in 40 CFR 136.3.

   d. The test data will be evaluated for reasonable potential at the conclusion of the test period. The data may be evaluated sooner if requested by the permittee, or if toxicity has been noted. Should evaluation of the data indicate that a limit is needed, a WET limit and compliance schedule will be required and the toxicity tests of Part I.E.1.a. may be discontinued.

   e. The permit may be modified or revoked and reissued to include pollutant specific limits in lieu of a WET limit should it be demonstrated that toxicity is due to specific parameters. The pollutant specific limits must control the toxicity of the effluent.

2. Reporting Schedule
   The permittee shall submit the toxicity test reports with the DMR for the tests specified in accordance with the following schedule:

Period	Compliance Date	Submittal Date
Annual 1	By 12/31/2010	By 01/10/2011
Annual 2	By 12/31/2011	By 01/10/2012
Annual 3	By 12/31/2012	By 01/10/2013
Annual 4	By 12/31/2013	By 01/10/2014
Annual 5	By 12/31/2014	By 01/10/2015

Spreadsheet for determination of WET test endpoints or WET limits

Excel 97
Revision Date: 01/10/05
File: WETLIM10.xls
(MIX.EXE required also)

Enter data in the cells with blue type:

Entry Date:	11/16/09
Facility Name:	Richmond WWTP
VPDES Number:	VA0063177
Outfall Number:	001

Acute Endpoint/Permit Limit — **Use as LC_{50} in Special Condition, as TUa on DMR**

ACUTE 1.300000032 TUa — LC_{50} = 77 % Use as 1.29 TUa

ACUTE WLAa 1.3

Note: Inform the permittee that if the mean of the data exceeds this TUa: 1.0 a limit may result using WLA.EXE

Chronic Endpoint/Permit Limit — **Use as NOEC in Special Condition, as TUc on DMR**

CHRONIC	13.00000032	TU_c	NOEC =	8	% Use as	12.50	TU_c
BOTH*	13.00000032	TU_c	NOEC =	8	% Use as	12.50	TU_c
AML	13.00000032	TU_c	NOEC =	8	% Use as	12.50	TU_c

ACUTE WLAa,c 13
CHRONIC WLAc 8.88888889
* Both means acute expressed as chronic

Note: Inform the permittee that if the mean of the data exceeds this TUc: 5.34228085 a limit may result using WLA.EXE

% Flow to be used from MIX.EXE

Plant Flow:	45 MGD		
Acute 1Q10:	300 MGD	50 %	
Chronic 7Q10:	355 MGD	100 %	

Difuser /modeling study?

Enter Y/N N
Acute 1 :1
Chronic 1 :1

Are data available to calculate CV? (Y/N) N (Minimum of 10 data points, same species, needed) Go to Page 2
Are data available to calculate ACR? (Y/N) N (NOEC<LC50, do not use greater/less than data) Go to Page 3

IWC_a	23.07692308	%	Plant flow/plant flow + 1Q10
IWC_c	11.25	%	Plant flow/plant flow + 7Q10
Dilution, acute	4.333333333		100/IWCa
Dilution, chronic	8.888888889		100/IWCc

NOTE: If the IWCa is >33%, specify the NOAEC = 100% test/endpoint for use

WLA_a	1.3	Instream criterion (0.3 TUa) X's Dilution, acute
WLA_c	8.888888889	Instream criterion (1.0 TUc) X's Dilution, chronic
$WLA_{a,c}$	13	ACR X's WLA_a - converts acute WLA to chronic units
ACR -acute/chronic ratio	10	LC50/NOEC (Default is 10 - if data are available, use tables Page 3)
CV-Coefficient of variation	0.6	Default of 0.6 - if data are available, use tables Page 2)
Constants eA	0.4109447	Default = 0.41
eB	0.6010373	Default = 0.60
eC	2.4334175	Default = 2.43
eD	2.4334175	Default = 2.43 (1 samp) No. of samples: 1

****The Maximum Daily Limit is calculated from the lowest LTA, X's eC. The LTAa,c and MDL using it are driven by the ACR.**

$LTA_{a,c}$	5.3422811	WLAa,c X's eA							
LTA_c	5.342553778	WLAc X's eB					Rounded NOEC's		%
MDL** with $LTA_{a,c}$	13.00000032	TU_c	NOEC =	7.692308	(Protects from acute/chronic toxicity)		NOEC =	8	%
MDL** with LTA_c	13.00066386	TU_c	NOEC =	7.691915	(Protects from chronic toxicity)		NOEC =	8	%
AML with lowest LTA	13.00000032	TU_c	NOEC =	7.692308	Lowest LTA X's eD		NOEC =	8	

IF ONLY ACUTE ENDPOINT/LIMIT IS NEEDED, CONVERT MDL FROM TU_c to TU_a

						Rounded LC50's	%
MDL with $LTA_{a,c}$	1.300000032	TU_a	LC50 =	76.923075	%	LC50 = 77	%
MDL with LTA_c	1.300066386	TU_a	LC50 =	76.919149	%	LC50 = 77	

Page 2 - Follow the directions to develop a site specific CV (coefficient of variation)

IF YOU HAVE AT LEAST 10 DATA POINTS THAT ARE QUANTIFIABLE (NOT "<" OR ">") FOR A SPECIES, ENTER THE DATA IN EITHER COLUMN "G" (VERTEBRATE) OR COLUMN "J" (INVERTEBRATE). THE 'CV' WILL BE PICKED UP FOR THE CALCULATIONS BELOW. THE DEFAULT VALUES FOR eA, eB, AND eC WILL CHANGE IF THE 'CV' IS ANYTHING OTHER THAN 0.6.

Coefficient of Variation for effluent tests

CV = 0.6 (Default 0.6)

δ^2 = 0.3074847

δ = 0.554513029

Using the log variance to develop eA
(P. 100, step 2a of TSD)

Z = 1.881 (97% probability stat from table

A = -0.88929666

eA = 0.410944686

Using the log variance to develop eB
(P. 100, step 2b of TSD)

δ_4^2 = 0.086177696

δ_4 = 0.293560379

B = -0.50909823

eB = 0.601037335

Using the log variance to develop eC
(P. 100, step 4a of TSD)

δ^2 = 0.3074847

δ = 0.554513029

C = 0.889296658

eC = 2.433417525

Using the log variance to develop eD
(P. 100, step 4b of TSD)

n = 1 This number will most likely stay as "1", for 1 sample/month.

δ_n^2 = 0.3074847

δ_n = 0.554513029

D = 0.889296658

eD = 2.433417525

	Vertebrate IC_{25} Data or LC_{50} Data	LN of data		Invertebrate IC_{25} Data or LC_{50} Data	LN of data
	**********			**********	
1	0		1	0	
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		
8			8		
9			9		
10			10		
11			11		
12			12		
13			13		
14			14		
15			15		
16			16		
17			17		
18			18		
19			19		
20			20		
St Dev	NEED DATA	NEED DATA	St Dev	NEED DATA	NEED DATA
Mean	0	0	Mean	0	0
Variance	0	0.000000	Variance	0	0.000000
CV	0		CV	0	

Page 3 - Follow directions to develop a site specific ACR (Acute to Chronic Ratio)

To determine Acute/Chronic Ratio (ACR), insert usable data below. Usable data is defined as valid paired test results, acute and chronic, tested at the same temperature, same species. The chronic NOEC must be less than the acute LC_{50}, since the ACR divides the LC_{50} by the NOEC. LC_{50}'s >100% should not be used.

Table 1. ACR using Vertebrate data

Set #	LC_{50}	NOEC	Test ACR	Logarithm	Geomean	Antilog	ACR to Use
1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
				ACR for vertebrate data:			0

Table 1. Result:	Vertebrate ACR	0
Table 2. Result:	Invertebrate ACR	0
	Lowest ACR	Default to 10

Table 2. ACR using Invertebrate data

Set #	LC_{50}	NOEC	Test ACR	Logarithm	Geomean	Antilog	ACR to Use
1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
				ACR for vertebrate data:			0

Table 3. Convert LC_{50}'s and NOEC's to Chronic TU's for use in WLA.EXE

ACR used: 10

	Enter LC_{50}	TUc	Enter NOEC	TUc
1		NO DATA		NO DATA
2		NO DATA		NO DATA
3		NO DATA		NO DATA
4		NO DATA		NO DATA
5		NO DATA		NO DATA
6		NO DATA		NO DATA
7		NO DATA		NO DATA
8		NO DATA		NO DATA
9		NO DATA		NO DATA
10		NO DATA		NO DATA
11		NO DATA		NO DATA
12		NO DATA		NO DATA
13		NO DATA		NO DATA
14		NO DATA		NO DATA
15		NO DATA		NO DATA
16		NO DATA		NO DATA
17		NO DATA		NO DATA
18		NO DATA		NO DATA
19		NO DATA		NO DATA
20		NO DATA		NO DATA

If WLA.EXE determines that an acute limit is needed, you need to convert the TUc answer you get to TUa and then an LC50,

enter it here: NO DATA %LC_{50}

NO DATA TUa

DILUTION SERIES TO RECOMMEND

Table 4.

	Monitoring		Limit	
	% Effluent	TUc	% Effluent	TUc
Dilution series based on data mean	18.7	5.3422808		
Dilution series to use for limit			8	12.5
Dilution factor to recommend:	0.4326499		0.2828427	
Dilution series to recommend:	100.0	1.00	100.0	1.00
	43.3	2.31	28.3	3.54
	18.7	5.34	8.0	12.50
	8.1	12.35	2.3	44.19
	3.50	28.54	0.6	156.25
Extra dilutions if needed	1.52	65.97	0.2	552.43
	0.66	152.47	0.1	1953.13

Cell: I9
Comment:
This is assuming that the data are Type 2 data (none of the data in the data set are censored - "<" or ">").

Cell: K18
Comment: This is assuming that the data are Type 2 data (none of the data in the data set are censored - "<" or ">").

Cell: J22
Comment: Remember to change the "N" to "Y" if you have ratios entered, otherwise, they won't be used in the calculations.

Cell: C40
Comment:
If you have entered data to calculate an ACR on page 3, and this is still defaulted to "10", make sure you have selected "Y" in cell E21

Cell: C41
Comment: If you have entered data to calculate an effluent specific CV on page 2, and this is still defaulted to "0.6", make sure you have selected "Y" in cell E20

Cell: L48
Comment:
See Row 151 for the appropriate dilution series to use for these NOEC's

Cell: G62
Comment:
Vertebrates are:
Pimephales promelas
Oncorhynchus mykiss
Cyprinodon variegatus

Cell: J62
Comment:
Invertebrates are:
Ceriodaphnia dubia
Mysidopsis bahia

Cell: C117
Comment: Vertebrates are:

Pimephales promelas
Cyprinodon variegatus

Cell: M119
Comment: The ACR has been picked up from cell C34 on Page 1. If you have paired data to calculate an ACR, enter it in the tables to the left, and make sure you have a "Y" in cell E21 on Page 1. Otherwise, the default of 10 will be used to convert your acute data.

Cell: M121
Comment: If you are only concerned with acute data, you can enter it in the NOEC column for conversion and the number calculated will be equivalent to the TUa. The calculation is the same: 100/NOEC = TUc or 100/LC50 = TUa.

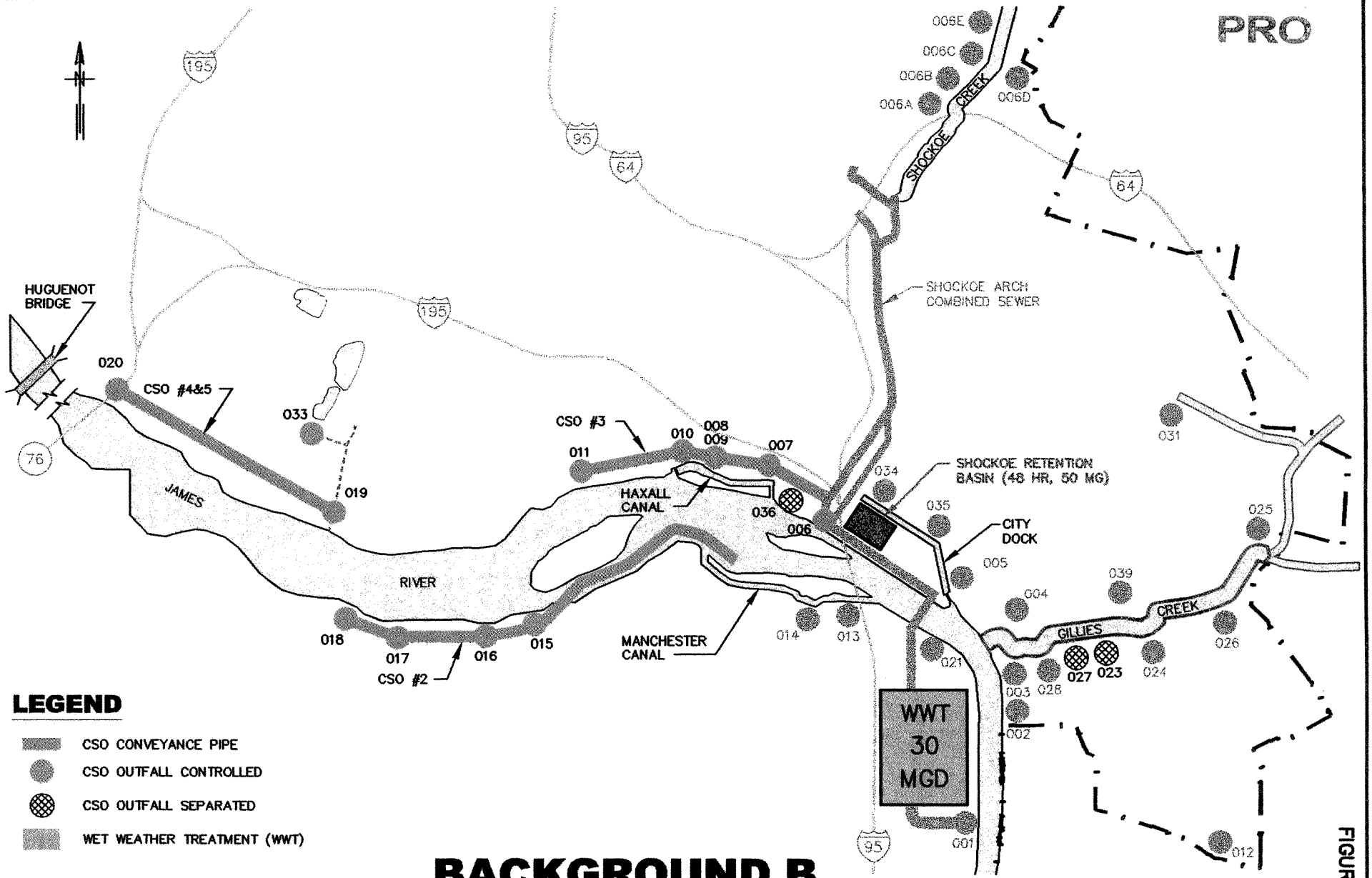
Cell: C138
Comment: Invertebrates are:

Ceriodaphnia dubia
Mysidopsis bahia

Attachment J

CSS Maps

FILE: S:\CLIENTS\RICH\0217E\CSOEVAL\RPTS\LTCPEVRPFINAL\SECTION 5\FIG5.4-22 1:2000 12/18/01 20:39 GH-F



LEGEND

- CSO CONVEYANCE PIPE
- CSO OUTFALL CONTROLLED
- CSO OUTFALL SEPARATED
- WET WEATHER TREATMENT (WWT)

BACKGROUND B

AFTER PHASE II IMPROVEMENTS

GREELEY AND HANSEN LLC

CITY OF RICHMOND, VIRGINIA
DEPARTMENT OF PUBLIC UTILITIES
CSO RE-EVALUATION FINAL REPORT
JANUARY 2002

FIGURE 5.4-22

FIGURE 2.2–4

LEGEND

- C — C — COMBINED INTERCEPTOR
- CT — CT — COMBINED TRUNK
- S — S — SANITARY INTERCEPTOR
- ST — ST — SANITARY TRUNK
- (031) CSO OUTFALL NUMBER AND LOCATION
- NORTHSIDE JAMES RIVER PARK CSO AREA
- SOUTHSIDE JAMES RIVER PARK CSO AREA
- GILLIES CREEK CSO AREA
- SHOCKOE CREEK CSO AREA
- MANCHESTER CANAL CSO AREA
- REMOTE CSO AREA
- SEPARATE SEWER AREA

INTERCEPTING AND TRUNK SEWER SYSTEM SERVING SEPARATE AND COMBINED SEWER AREAS

GREELEY AND HANSEN LLC

CITY OF RICHMOND, VIRGINIA
DEPARTMENT OF PUBLIC UTILITIES
CSO RE–EVALUATION FINAL REPORT
JANUARY 2002

FILE: S:\CLIENTS\RICH\0217E\CSOEVAL\RPTS\LTCPEVRPFINAL\SECTION 2\FIG2.2-4 1:2000 12/18/01 17:48 GH-F

Attachment K

Application Waivers

CITY OF RICHMOND
DEPARTMENT OF PUBLIC UTILITIES
DIVISION OF WASTEWATER TREATMENT

November 15, 2007

Virginia R. Kelly
Department of Environmental Quality
4949-A Cox Road
Glen Allen Va. 23060-6269

RE: Permit application waiver for: Richmond Wastewater Treatment Plant (VA0063177)

Dear Ms. Kelly:

Richmond WWTP is in the process of preparing it permit application for submittal to the DEQ. Richmond is taking this opportunity to request a wavier for its treatment facility that will be applying for permit reissue in 2009.

Per 9 VAC25-31-100J. , Richmond is requesting a wavier to submit dissolved metals data in lieu of total recoverable metals data to complete Form 2A. Part D (expanded effluent testing). The Virginia Water Quality Standards,9VAC25-260-5et.seq., list requirements which apply to dissolved metals. Therefore, it is more representative to provide dissolved metal data to DEQ for your evaluation of reasonable potential by the plant effluent to exceed the water quality standards of the receiving waters. Richmond believes that total recoverable metals data is not of material concern for this VPDES permit.

Please contact me at 804-646-8903 if you have any questions. Thank you for your consideration of this waiver request.

Sincerely,

Clair L Watson
Supt. of Plant Operations

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

PIEDMONT REGIONAL OFFICE
4949-A Cox Road, Glen Allen, Virginia 23060
(804) 527-5020 Fax (804) 527-5106
www.deq.virginia.gov

L. Preston Bryant, Jr.
Secretary of Natural Resources

David K. Paylor
Director

Gerard Seeley, Jr.
Regional Director

DEC 0 4 2007

Mr. Mark Smith (3WP12)
U.S. Environmental Protection Agency, Region III
1650 Arch Street
Philadelphia, PA 19103-2029

RE: VPDES Permit No. VA0063177, Richmond WWTP, City of Richmond, Application Form 2A Testing Waiver Request

Dear Mr. Smith:

The Virginia Department of Environmental Quality is in receipt of a request for waiver of certain testing requirements of NPDES Application Form 2A. On behalf of the Director and in accordance with sections 9 VAC 25-31-100.E.4 and J of the Virginia Pollutant Discharge Elimination System Permit Regulation, the applicant's waiver request is being submitted to you for EPA approval. Attached is a copy of the DEQ waiver request memorandum approval and correspondence from the applicant detailing their request.

Please send any comments and/or objections regarding this waiver request to the Virginia Department of Environmental Quality, at the following address:

Virginia DEQ
Office of Water Permit Programs
P.O. Box 10009
Richmond, Virginia 23240

Also, please copy Gina Kelly, of the Piedmont Regional Office permitting staff, at vekelly@deq.virginia.gov on any correspondence.

If EPA does not comment or object within 29 days of receipt of this notification; the waiver request will be deemed acceptable to the Regional Administrator.

Sincerely,

Curtis J. Linderman, P.E.
Water Permit Manager

Enclosures
cc: OWPP

MEMORANDUM

DEPARTMENT OF ENVIRONMENTAL QUALITY
Piedmont Regional Office

4949-A Cox Road, Glen Allen, Virginia 23060-6295 804/527-5020

TO: Curt Linderman
FROM: Gina Kelly GK
DATE: December 4, 2007
SUBJECT: Waiver Request for VA0063177 – Richmond WWTP
COPIES: File (R/W)

The attached waiver request is from Richmond WWTP, VA0063177. Please note the following:

- The facility has a design flow rate of 75 MGD.
- The facility requested a sampling waiver for total recoverable metals (substituting dissolved metals data).
- Justifications cited for the waiver are:
  (1) the cost of testing;
  (2) Virginia WQS are in terms of dissolved metals and it is more representative to provide dissolved metals data to DEQ for evaluations of the facility's reasonable potential to violate applicable water quality standards.

Testing to total recoverable metals is a requirement of the reissuance application via the EPA For 2A. While DEQ permitting staff can demonstrate metals limits are not necessary using total recoverable metals data, staff can o0nly establish water quality based effluent limitations based on dissolved metals data. Dissolved sampling enables DEQ to compare the sampling results directly with the applicable water quality standard and associated wasteload location whereas total recoverable metals sampling does not. Accordingly, I recommend accepting dissolved metals sampling in lieu of the required total recoverable metals sampling (e.g. waiving the total recoverable metals sampling requirement).

☒ Approved ☐ Denied

Comments: _____

Signature

12/4/07
Date

Attachment L

Consent Order

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

W. Tayloe Murphy, Jr.
Secretary of Natural Resources

PIEDMONT REGIONAL OFFICE
4949-A Cox Road
Glen Allen, Virginia 23060
(804) 527-5020
Fax (804) 527-5106
www.deq.state.va.us

Robert G. Burnley
Director

Gerard Seeley, Jr.
Piedmont Regional Director

STATE WATER CONTROL BOARD ENFORCEMENT ACTION
SPECIAL ORDER BY CONSENT
ISSUED TO
THE CITY OF RICHMOND
Permit No. VA0063177

SECTION A: Purpose

This is a Consent Special Order issued under the authority of Va. Code §§ 10.1-1185 and 62.1-44.15(8a), between the State Water Control Board and the City of Richmond. This Order supercedes and replaces the Consent Special Order issued to the City on October 8, 1999, regarding implementation of a plan to control combined sewer overflow discharges to the James River.

SECTION B: Definitions

Unless the context clearly indicates otherwise, the following words and terms have the meaning assigned to them below:

1. "Va. Code" means the Code of Virginia (1950), as amended.

2. "Board" means the State Water Control Board, a permanent citizens' board of the Commonwealth of Virginia as described in Va. Code §§ 10.1-1184 and 62.1-44.7.

3. "Department" or "DEQ" means the Department of Environmental Quality, an agency of the Commonwealth of Virginia as described in Va. Code § 10.1-1183.

4. "Director" means the Director of the Department of Environmental Quality.

5. "Order" means this document, also known as a Consent Special Order.

6. "City" means the City of Richmond, Virginia.

7. "Facility" means a component of the City of Richmond's wastewater treatment works located in Richmond, Virginia.

8. "Functioning Element" means a component of a project that if constructed and placed in operation will provide some part of the overall beneficial function of the project.

9. "Place in Operation" or "Placing a Facility in Operation" means to achieve consistent operations following completion of a startup and test period in such a way as to accomplish the intended function, even though all construction activities (such as completion of a punch-list, resolution of contract disputes and other close-out items) may not be completed.

10. "PRO" means the Piedmont Regional Office of DEQ, located in Glen Allen, Virginia.

11. "Permit" means VPDES permit No. VA0063177, issued to the City and any future, extended, modified or reissued permit.

12. "O&M" means operations and maintenance.

13. "WWTP" means wastewater treatment plant.

14. "CSO" means combined sewer overflow, a term which is used to describe overflows from a combined sanitary and stormwater sewer system.

15. "CSS" means combined sewer system consisting of the pipelines, pumping stations, and treatment facilities in the City which are designed to convey wastewater and storm water through a single pipe system to a combined sewer overflow outfall and/or the WWTP.

16. "CSO Policy" means EPA's April 19, 1994 CSO Control Policy, published at 59 Fed Reg 18688, and incorporated into the Clean Water Act pursuant to the Wet Weather Water Quality Act, Section 402(q) of the Clean Water Act, 33 U.S.C. § 1342.

17. "City Charter" means the Richmond Charter of 1948, as amended from time to time.

18. "Indenture" means the Master Indenture of Trust of April 1, 1998 between the City of Richmond and Crestar, now Suntrust, Bank, as amended from time to time.

19. LTCP" means Long Term Control Plan, which is the plan for controlling CSOs from the City's CSS that has been prepared by the City pursuant to the CSO Policy and submitted to DEQ as a final report in January 2002 and all supplements thereto.

20. "CCF" means hundred cubic feet.

21. "Treatment Works" means those devices and systems described at 9VAC 25-31-10.

SECTION C: Findings of Fact and Conclusions of Law

1. The City of Richmond owns and operates a combined sanitary and stormwater sewer system which, during periods of rainfall, discharges pollutants from some or all of twenty-nine (29) CSO outfalls to the James River and its local tributaries. The City's CSO discharges are authorized by VPDES Permit No. VA0063177.

2. The City has been cooperating with the State Water Control Board since the mid-1970s to address combined sewer overflow impacts on the James River. The City's compliance with Consent Orders and Permits issued since that time have resulted in the implementation of best management practices and the completion of major construction projects that have significantly reduced the volume, frequency and impacts of combined sewer overflows during storm events.

3. The CSO Policy calls for localities with combined sewer systems to prepare LTCPs that meet certain minimum technical criteria and ultimately result in compliance with state water quality standards.

4. The most recent Consent Order; issued to the City on October 8, 1999; required the City to evaluate its progress with respect to the CSO Policy, and recommend a course of future actions to comply with that policy. The City prepared the evaluation, obtained public comment and submitted to DEQ an LTCP on January 2, 2002, which was presented to the Board on May 6, 2002. In its LTCP, the City identified several alternatives for future actions and recommended one that is referred to as CSO Control Plan E. This control plan is reflected in Appendix B of this Order and has been submitted by the City to satisfy the "Demonstration" approach criteria of Section II.C.4.b. of the CSO Policy. However, the Board has not completed the water quality standards coordination process provided in Section III of the CSO Policy, and, therefore, is unable to determine at this time that the recommended plan makes the water quality standards compliance demonstration called for in Section II.C.4.b.i and ii. of the CSO Policy. Accordingly, the water quality standards coordination process will continue until the Board makes such a determination.

SECTION D: Agreement and Order

Accordingly, the Board, by virtue of the authority granted it in Va. Code § 62.1- 4.15(8a), orders the City, and the City agrees, that:

1. The previous Order issued on October 8, 1999 is terminated.

2. The Board accepts the City's January 2002 LTCP and approves CSO Control Plan E, as described in the LTCP subject to the Board completing its ongoing water quality standards coordination process pursuant to Section III of the CSO Policy and the Board's determination that the recommended plan makes the water quality standards compliance demonstration called for in Section II.C.4.b.i and ii of the CSO Policy.

3. The City shall implement CSO Control Plan E in accordance with the schedule in Appendix A of this Order.

4. If at any time prior to the termination of this order, the Clean Water Act, 33 U.S.C. § 1251 et seq., is modified, or EPA duly promulgates new regulations to establish requirements for the control of CSO's in conflict with one or more provisions of this Order, the City and the Board agree to modify or terminate this order to comply with such federal requirements.

5. New, more cost effective technologies or improvements in the performance of the LTCP, are expected during implementation. At any time the City or Department becomes aware of such new technology or performance improvements, a joint evaluation of the new technology or proposed modification will be undertaken to determine if the LTCP and this Order should be modified.

SECTION E: Administrative Provisions

1. The Board may modify or amend this Order with the consent of the City, or for good cause shown by the City, or on its own motion after notice and opportunity to be heard.

2. This Order only addresses the matters specified herein. This Order shall not preclude the Board or the Director from taking any action authorized by law, including but not limited to: (1) taking any action authorized by law regarding any violations not specifically addressed herein; or (2) taking subsequent action to enforce this Order. This Order shall not preclude appropriate enforcement actions by other federal, state, or local regulatory authorities for matters not addressed herein.

3. Nothing herein shall be construed as altering, modifying or amending any term or condition contained in VPDES Permit No. VA0063177.

4. For purposes of this Order and subsequent actions with respect to this Order, the City admits the jurisdictional allegations, factual findings, and conclusions of law contained herein. In agreeing to this Order however, the City shall not be deemed to have admitted that it is violating any federal or state law, rule, regulation, standard or criterion.

5. The City consents to venue in the Circuit Court of the City of Richmond for any civil action taken to enforce the terms of this Order.

6. The City acknowledges it has received fair and due process under the Administrative Process Act, Va. Code §§ 2.2-4000 et seq., and the State Water Control Law and it waives the right to any hearing or other administrative proceeding authorized or required by law or regulation, and to any judicial review of any issue of fact or law contained herein. Nothing herein shall be construed as a waiver of the right to any administrative proceeding for, or to judicial review of, any action taken by the Board to enforce this Order.

7. Failure by the City to comply with any of the terms of this Order shall constitute a violation of an order of the Board. Nothing herein shall waive the initiation of appropriate enforcement actions or the issuance of additional orders as appropriate by the Board or the Director as a result of such violations. Nothing herein shall affect appropriate enforcement actions by any other federal, state, or local regulatory authority.

8. If any provision of this Order is found to be unenforceable for any reason, the remainder of the Order shall remain in full force and effect.

9. The City shall be responsible for failure to comply with any of the terms and conditions of this Order unless compliance is made impossible by earthquake, flood, other acts of God, war, strike, or other event beyond the control of the City, or its contractors or agents that will delay or prevent the performance on any obligation under this Order. The City shall show that such circumstances were beyond its control and not due to a lack of good faith or diligence on its part. The City shall notify the PRO Regional Director in writing when circumstances are anticipated to occur, are occurring, or have occurred that may delay compliance or cause noncompliance with any requirement of the Order. Such notice shall set forth the reasons for the delay or noncompliance, the projected duration of any such delay or noncompliance, the measures taken and to be taken to prevent or minimize such delay or noncompliance and the timetable by which such measures will be implemented and the date full compliance will be achieved. Failure to so notify the Regional Director within 30 days of learning of any condition, which the City intends to assert will result in the impossibility of compliance, shall constitute a waiver of any claim of inability to comply with a requirement of this Order. The City may assert and it shall be a defense to any enforcement action for alleged violation of this Order that the alleged violation was beyond the control of the City.

10. This Order is binding on the parties hereto, their successors in interest, designees and assigns, jointly and severally.

11. This Order shall become effective upon execution by both the Director or his designee and the City. Notwithstanding the foregoing, the City agrees to be bound by any compliance date, which precedes the effective date of this O

12. This Order shall continue in effect until the Director or Board terminates the Order upon 30 days written notice to the City. Such termination shall be a case decision within the meaning of Virginia Code § 2.2 – 4019 and Rule 2A:2 of the rules of the Supreme Court of Virginia. Termination of this Order, or any obligation imposed in this Order, shall not operate to relieve the City from its obligation to comply with any statute, regulation, permit condition, other order, certificate, certification, standard, or requirement otherwise applicable.

13. Communications regarding this Order, and its requirements shall be addressed as follows:

Department of Environmental Quality
Piedmont Regional Office
4949-A Cox Road
Glen Allen, Virginia 23060
Attn. Water Enforcement Specialist

And it is so ORDERED this day of March 17, 2005.

Gerard Seeley Jr. (for)
Robert G. Burnley, Director
Department of Environmental Quality

The City voluntarily agrees to the issuance of this Order.

By: _____
William E. Harrell,
Interim Chief Administrative Officer
City of Richmond, Virginia

Date: 2/8/05

Approved As To Form

By: _____
David W. Seitz, Assistant City Attorney

Date: 2/7/05

Commonwealth of Virginia
City/County of Richmond

The foregoing document was signed and acknowledged before me this 8th day of February, 2005, by William E. Harrell, who is Interim Chief Administrative Officer of the City, on behalf of the City.

Mildred D. Kennedy
Notary Public

My commission expires: October 31, 2005

RECEIVED
FEB 09 2005
PRO

APPENDIX A

Implementation Schedule for Richmond's CSO Long Term Control Plan (LTCP)

SECTION A.1.

The City shall implement the CSO Control Plan E projects set forth in Appendix B to this Order on the following schedule.

The City shall raise revenue for implementation of CSO Control Plan E to the limit of its financial capability. The City shall be deemed to be raising CSO control project funds to the limit of its financial capability if the following criteria are met:

1. At least bi-annually the City adjusts its sewer rates so that within five years of the effective date of this Order:

   a The annual sewer bill for typical residential customers (i.e. 7 ccf of average monthly use) will be at least 1.25% of median household income[1]; and

   b The sewer volume rate for customers identified as industrial users in the City's utility billing records will equal the rate charged to the City's residential customers.

2. The City periodically borrows funds for Treatment Works related projects, including CSO control projects, according to City Charter and Indenture and maintains a Wastewater Utility debt coverage ratio, as defined in the indenture, below 1.75.

3. The City annually seeks grant funding for CSO control projects in the LTCP from all applicable federal and state sources.

SECTION A.2.

Each fiscal year following the effective date of this order the City shall allocate and spend available funds on appropriated CSO control projects in Appendix B in accordance with the schedule in this Appendix A. The City shall, however, not be required to spend funds to construct part of a project unless that part will provide a Functioning Element. Available funds for CSO control projects shall include annual sewer revenues remaining after deducting from those revenues the monies required for the following:

- Operating expenses,
- Non-operating expenses,

[1] As reflected in the 2000 and any subsequent census. In the years between each census, the median household income (MHI) shall be adjusted based on the percent increase in the consumer price index– all urban consumers U.S. city average (CPI-U) for that year.

- Any other expenditures required to comply with any federal, state or local water quality related requirements associated with the City's combined sewer system and Treatment Works.

Available funds for CSO control projects also include any loan and grant funds obtained for the purpose of implementing CSO projects identified in the LTCP.

SECTION A.3.

The City shall plan, design, construct, startup, test and place in operation the CSO Control Plan E projects in Appendix B, in accordance with the following schedule:

REQUIREMENTS	MILESTONES
1. CSO Disinfection Study: Submit to the Department a final report on a disinfection pilot study to determine the most effective method of disinfecting CSO discharges at the Shockoe retention basin and the City's WWTP	Not Later Than (NLT) June 30, 2005
2. Phase III Program Project Plan: Submit to the Department, for it's review and approval, a program project plan(s) for implementing the elements of the CSO Control Plan E.	NLT December 31, 2006
3. Solids and Floatable Control Regulator for CSO Outfall No. 024:	
a. Submit to the Department for its approval the Preliminary Design Report for the Solids and Floatable Control Regulator for CSO Outfall No. 024	NLT 3 months after issuance of this Order.
b. Submit to the Department for its approval the final drawings and specifications for Solids and Floatable Control Regulator for CSO Outfall No. 024	NLT 6 months after approval of activities under Requirement 3.a.
c. Construct, startup, and test the Solids and Floatable Control Regulator for CSO Outfall No. 024	NLT 20 months after approval of the final drawings and specifications under Requirement 3.b.
d. Place in Operation the Solids and Floatable Control Regulator for CSO Outfall No. 024	NLT 1 month after completion of activities under Requirement 3.c.

REQUIREMENTS	MILESTONES
4. Solids and Floatable Control Regulator for CSO Outfall No. 026:	
a. Submit to the Department for its approval the Preliminary Design Report for the Solids and Floatable Control Regulator for CSO Outfall No. 026	NLT 3 months after issuance of this Order.
b. Submit to the Department for its approval the final drawings and specifications for Solids and Floatable Control Regulator for CSO Outfall No. 026	NLT 6 months after approval of activities under Requirement 4.a.
c. Construct, startup, and test the Solids and Floatable Control Regulator for CSO Outfall No. 026	NLT 20 months after approval of the final drawings and specifications under Requirement 4.b.
d. Place in Operation the Solids and Floatable Control Regulator for CSO Outfall No. 026	NLT 1 month after completion of activities under Requirement 4.c.
5. Solids and Floatable Control Regulator for CSO Outfall No. 025:	
a. Submit to the Department for its approval the Preliminary Design Report for the Solids and Floatable Control Regulator for CSO Outfall No. 025	NLT 3 months after issuance of this Order.
b. Submit to the Department for its approval the final drawings and specifications for Solids and Floatable Control Regulator for CSO Outfall No. 025	NLT 6 months after approval of activities under Requirement 5.a.
c. Construct, startup, and test the Solids and Floatable Control Regulator for CSO Outfall No. 025	NLT 20 months after approval of the final drawings and specifications under Requirement 5.b.
d. Place in Operation the Solids and Floatable Control Regulator for CSO Outfall No. 025	NLT 1 month after completion of activities under Requirement 5.c.

REQUIREMENTS	MILESTONES
6. Fulton Bottom Urban Renewal Separation Project:	
a. Submit to the Department for its approval the Preliminary Design Report for the Fulton Bottom Urban Renewal Separation Project	NLT 3 months after the Phase III Program Project Plan under Requirement 2.
b. Submit to the Department for its approval the final drawings and specifications for the Fulton Bottom Urban Renewal Separation Project	NLT 6 months after approval of activities under Requirement 6.a.
c. Construct, startup, and test the Fulton Bottom Urban Renewal Separation Project	NLT 36 months after approval of the final drawings and specifications under Requirement 6.b.
d. Place in Operation the Fulton Bottom Urban Renewal Separation Project	NLT 1 month after completion of activities under Requirement 6.c.
7. Maury Street Separation Project:	
a. Submit to the Department for its approval the Preliminary Design Report for the Maury Street Separation Project	NLT 3 months after the Phase III Program Project Plan under Requirement 2.
b. Submit to the Department for its approval the final drawings and specifications for the Maury Street Separation Project	NLT 6 months after approval of activities under Requirement 7.a.
c. Construct, startup, and test the Maury Street Separation Project	NLT 48 months after approval of the final drawings and specifications under Requirement 7.b.
d. Place in Operation the Maury Street Separation Project	NLT 1 month after completion of activities under Requirement 7.c.

REQUIREMENTS	MILESTONES
8. Orleans and Nicholson Streets Separation Project:	
a. Submit to the Department for its approval the Preliminary Design Report for the Orleans and Nicholson Streets Separation Project	NLT 3 months after the Phase III Program Project Plan under Requirement 2.
b. Submit to the Department for its approval the final drawings and specifications for the Orleans and Nicholson Streets Separation Project	NLT 6 months after approval of activities under Requirement 8.a.
c. Construct, startup, and test the Orleans and Nicholson Streets Separation Project	NLT 60 months after approval of the final drawings and specifications under Requirement 7.b.
d. Place in Operation the Orleans and Nicholson Streets Separation Project	NLT 1 month after completion of activities under Requirement 8.c.
9. Oakwood Peripheral In-Line Flow Equalization:	
a. Submit to the Department for its approval the Preliminary Design Report for the Oakwood Peripheral In-Line Flow Equalization	NLT 3 months after the Phase III Program Project Plan under Requirement 2.
b. Submit to the Department for its approval the final drawings and specifications for the Oakwood Peripheral In-Line Flow Equalization	NLT 6 months after approval activities under Requirement 9.a.
c. Construct, startup, and test the Oakwood Peripheral In-Line Flow Equalization	NLT 72 months after approval of the final drawings and specifications under Requirement 9.b.
d. Place in Operation the Oakwood Peripheral In-Line Flow Equalization	NLT 1 month after completion of activities under Requirement 9.c.

REQUIREMENTS	MILESTONES
10. Solids and Floatable Control Regulator for CSO Outfall No. 012:	
a. Submit to the Department for its approval the Preliminary Design Report for the Solids and Floatable Control Regulator for CSO Outfall No. 012	NLT 3 months after the Phase III Program Project Plan under Requirement 2.
b. Submit to the Department for its approval the final drawings and specifications for Solids and Floatable Control Regulator for CSO Outfall No. 012	NLT 6 months after approval of activities under Requirement 10.a.
c. Construct, startup, and test the Solids and Floatable Control Regulator for CSO Outfall No. 012	NLT 84 months after approval of the final drawings and specifications under Requirement 10.b.
d. Place in Operation the Solids and Floatable Control Regulator for CSO Outfall No. 012	NLT 1 month after completion of activities under Requirement 10.c.
11. Solids and Floatable Control Regulator for CSO Outfall No. 014:	
a. Submit to the Department for its approval the Preliminary Design Report for the Solids and Floatable Control Regulator for CSO Outfall No. 014	NLT 3 months after the Phase III Program Project Plan under Requirement 2.
b. Submit to the Department for its approval the final drawings and specifications for Solids and Floatable Control Regulator for CSO Outfall No. 014	NLT 6 months after approval of activities under Requirement 11.a.
c. Construct, startup, and test the Solids and Floatable Control Regulator for CSO Outfall No. 014	NLT 96 months after approval of the final drawings and specifications under Requirement 11.b.
d. Place in Operation the Solids and Floatable Control Regulator for CSO Outfall No. 014	NLT 1 month after completion of activities under Requirement 11.c.

REQUIREMENTS	MILESTONES
12. Solids and Floatable Control Regulator for CSO Outfall No. 039:	
a. Submit to the Department for its approval the Preliminary Design Report for the Solids and Floatable Control Regulator for CSO Outfall No. 039	NLT 3 months after of the Phase III Program Project Plan under Requirement 2.
b. Submit to the Department for its approval the final drawings and specifications for Solids and Floatable Control Regulator for CSO Outfall No. 039	NLT 6 months after approval of activities under Requirement 12.a.
c. Construct, startup, and test the Solids and Floatable Control Regulator for CSO Outfall No. 039	NLT 108 months after approval of the final drawings and specifications under Requirement 12.b.
d. Place in Operation the Solids and Floatable Control Regulator for CSO Outfall No. 039	NLT 1 month after completion of activities under Requirement 12.c.
13. Lower Gillies Creek Conveyance System Project:	
a. Submit to the Department for its approval the Preliminary Design Report for the Lower Gillies Creek Conveyance System Project	NLT 3 months after the Board or the Department determines that (1) Plan E satisfies all the criteria under Section II.C.4.b.i and ii of the CSO Policy, and (2) approval of the Phase III Program Project Plan under Requirement 2.
b. Submit to the Department for its approval the final drawings and specifications for the Lower Gillies Creek Conveyance System Project	NLT 9 months after completion or approval of activities under Requirement 13.a.
c. Construct, startup, and test the Lower Gillies Creek Conveyance System Project	At such time as the combined affordability and spending measures under Sections A.1. and A.2. produce revenue to proceed with construction of a Functioning Element or; if sufficient funds are available at the time of completion of final drawings and specifications, NLT 26 months after approval of the final drawings and specifications under Requirement 13.b.
d. Place in Operation the Lower Gillies Creek Conveyance System Project	NLT 1 month after completion of activities under Requirement 13.c.

REQUIREMENTS	MILESTONES
14. Wet Weather Flow Improvements at the WWTP: Solids Removal Improvements Project	
a. Submit to the Department for its approval the Preliminary Design Report for the Solids Removal Improvements Project	NLT 3 months after starting construction of the project under Requirement 13.c.
b. Submit to the Department for its approval the final drawings and specifications for the Solids Removal Improvements Project	NLT 9 months after completion or approval of activities under Requirement 14.a. (1)
c. Construct, startup, and test the Solids Removal Improvements Project	At such time as the combined affordability and spending measures under Sections A.1. and A.2. produce revenue to proceed with construction of a Functioning Element or; if sufficient funds are available at the time of completion of final drawings and specifications, NLT 26 months after approval of the final drawings and specifications under Requirement 14.a.(2)
d. Place in Operation for the Solids Removal Improvements Project	NLT 1 month after completion of activities under Requirement 14.a.(3)
15. Wet Weather Flow Improvements at the WWTP: Wet Weather Disinfection Facilities Project	
a. Submit to the Department for its approval the Preliminary Design Report for the Wet Weather Disinfection Facilities Project	NLT 3 months after starting construction of the project under Requirement 14.a.(3)
b. Submit to the Department for its approval the final drawings and specifications for the Wet Weather Disinfection Facilities Project	NLT 9 months after completion or approval of activities under Requirement 14.b.(1)
c. Construct, startup, and test the Wet Weather Disinfection Facilities Project	At such time as the combined affordability and spending measures under Sections A.1. and A.2. produce revenue to proceed with construction of a Functioning Element or; if sufficient funds are available at the time of completion of final drawings and specifications, NLT 26 months after approval of the final drawings and specifications under Requirement 14.b.(2)
d. Place in Operation for Wet Weather Disinfection Facilities Project	NLT 1 month after completion of activities under Requirement 14.b.(3)

REQUIREMENTS	MILESTONES
16. Wet Weather Flow Improvements at the WWTP: Expand Secondary Wet Weather Flow Treatment Project	
a. Submit to the Department for its approval the Preliminary Design Report for the Expand Secondary Wet Weather Flow Treatment Project	NLT 3 months after starting construction of the project under Requirement 14.b.(3)
b. Submit to the Department for its approval the final drawings and specifications for the Expand Secondary Wet Weather Flow Treatment Project	NLT 9 months after completion or approval of activities under Requirement 14.c.(1)
c. Construct, startup, and test the Expand Secondary Wet Weather Flow Treatment Project	At such time as the combined affordability and spending measures under Sections A.1. and A.2. produce revenue to proceed with construction of a Functioning Element or; if sufficient funds are available at the time of completion of final drawings and specifications, NLT 26 months after approval of the final drawings and specifications under Requirement 14.c.(2)
d. Place in Operation for Wet Weather Disinfection Facilities Project	NLT 1 month after completion of activities under Requirement 14.c.(3)
17. Shockoe Retention Basin: Adapt Existing Basin for Pass Through Wet Weather Flow Project	
a. Submit to the Department for its approval the Preliminary Design Report for the Adapt Existing Basin for Pass Through Wet Weather Flow Project	NLT 3 months after starting construction of the project under Requirement 14.c.(3)
b. Submit to the Department for its approval the final drawings and specifications for the Adapt Existing Basin for Pass Through Wet Weather Flow Project	NLT 9 months after completion or approval of activities under Requirement 15.a.(1)

REQUIREMENTS	MILESTONES
c. Construct, startup, and test the Adapt Existing Basin for Pass Through Wet Weather Flow Project	At such time as the combined affordability and spending measures under Sections A.1. and A.2. produce revenue to proceed with construction of a Functioning Element or; if sufficient funds are available at the time of completion of final drawings and specifications, NLT 26 months after approval of the final drawings and specifications under Requirement 15.a.(2)
d. Place in Operation for Adapt Existing Basin for Pass Through Wet Weather Flow Project	NLT 1 month after completion of activities under Requirement 15.a.(3)
18. Shockoe Retention Basin: Shockoe Retention Basin 15 MG Expansion Project	
a. Submit to the Department for its approval the Preliminary Design Report for the Shockoe Retention Basin 15 MG Expansion Project	NLT 3 months after starting construction of the project under Requirement 15.a.(3)
b. Submit to the Department for its approval the final drawings and specifications for the Shockoe Retention Basin 15 MG Expansion Project	NLT 9 months after completion or approval of activities under Requirement 15.b.(1)
c. Construct, startup, and test the Shockoe Retention Basin 15 MG Expansion Project	At such time as the combined affordability and spending measures under Sections A.1. and A.2. produce revenue to proceed with construction of a Functioning Element or; if sufficient funds are available at the time of completion of final drawings and specifications, NLT 38 months after approval of the final drawings and specifications under Requirement 15.b.(2)
d. Place in Operation for Shockoe Retention Basin 15 MG Expansion Project	NLT 1 month after completion of activities under Requirement 15.b.(3)

REQUIREMENTS	MILESTONES
19. Shockoe Retention Basin: Shockoe Wet Weather Disinfection Facility Project	
a. Submit to the Department for its approval the Preliminary Design Report for the Shockoe Wet Weather Disinfection Facility Project	NLT 3 months after starting construction of the project under Requirement 15.b.(3)
b. Submit to the Department for its approval the final drawings and specifications for the Shockoe Wet Weather Disinfection Facility Project	NLT 9 months after completion or approval of activities under Requirement 15.c.(1)
c. Construct, startup, and test the Shockoe Wet Weather Disinfection Facility Project	At such time as the combined affordability and spending measures under Sections A.1. and A.2. produce revenue to proceed with construction of a Functioning Element or; if sufficient funds are available at the time of completion of final drawings and specifications, NLT 26 months after approval of the final drawings and specifications under Requirement 15.c.(2)
d. Place in Operation for Shockoe Wet Weather Disinfection Facility Project	NLT 1 month after completion of activities under Requirement 15.c.(3)

SECTION A.4.

Beginning December 1, 2005, and no later than December 1st of each year thereafter, the City shall submit a compliance and progress report to the Department. The report shall describe progress made in the previous fiscal year in controlling CSO's and plans for further implementation of the LTCP in the near and long term future. The report shall include, at a minimum, the following elements:

1. An independent rate consultant report that includes schedules and other material designed to demonstrate compliance with the above funding and spending criteria. At a minimum, the independent rate consultant's report will include:

   a A schedule of sewer rates and charges in effect during the year and an explanation of any changes in the sewer rates and charges during the year;

   b A schedule that calculates the current year annual sewer bill for a residential customer with a 7 ccf average monthly sewer use and the percentage of such bill to median household income in the City;

   c A schedule detailing sewer related revenues, operation and maintenance expenses, net revenues, debt service, reserve funds and the sewer debt service coverage ratio for the previous year;

d A schedule detailing amounts borrowed, grants, and other sources of capital funds, and the amount of capital funds obligated for water quality projects during the previous year; and,

e A schedule displaying the industrial rate structure and progress toward the goal of parity between industrial and residential rates.

2. An accounting of all sums expended on implementation of specific CSO projects contained in the LTCP in the previous fiscal year and in each fiscal year since the effective date of this Order.

3. An accounting of all sums obligated in the current fiscal year, and funds projected to be obligated within the next five years for implementation of specific CSO projects contained in the LTCP.

4. A narrative report of the status of each CSO project identified in the LTCP including projected completion dates contingent upon funding availability.

5. A status report of progress being made in procuring state and federal grants and low interest loans for the purpose of implementing specific elements of the LTCP.

The City agrees to accommodate requests by the Department for changes in annual report format and additional information. The City also agrees to meet with the Department in December, 2005, and every December thereafter, to discuss the status of the CSO projects required under this Order.

APPENDIX B

Description of the Elements in Richmond's CSO Control Plan E

The City's Long-Term Control Plan (LTCP) components of the CSO Control Plan E are described in the following table:

PROJECTS	DESCRIPTION
1. CSO Disinfection Study	Determines the most cost effective method of disinfecting CSO discharges at the Shockoe retention basin and the City's WWTP
2. Phase III Program Project Plan	Develops program project plan(s) for implementing the elements of the CSO Control Plan E.
3. Solids and Floatable Control Regulator for CSO Outfall No. 024	Provides solids and floatables treatment for CSO Outfall 024 prior to discharge to Gillies Creek and the James River. Part of the project for Solids and Floatable Control Regulators (#III-7) in the City's Long Term Control Plan.
4. Solids and Floatable Control Regulator for CSO Outfall No. 026	Provides solids and floatables treatment for CSO Outfall 026 prior to discharge to Gillies Creek and the James River. Part of the project for Solids and Floatable Control Regulators (#III-7) in the City's Long Term Control Plan.
5. Solids and Floatable Control Regulator for CSO Outfall No. 025	Provides solids and floatables treatment for CSO Outfall 025 prior to discharge to Gillies Creek and the James River. Part of the project for Solids and Floatable Control Regulators (#III-7) in the City's Long Term Control Plan.
6. Fulton Bottom Urban Renewal Separation Project	Separates combined sewers into separate sewers for the conveyance of sanitary sewage and storm water to eliminate discharges of combined sewer overflows from this CSO area into Gillies Creek and the James River. Part of the project for Separation of Select CSO Basins (#III-5) in the City's Long Term Control Plan.
7. Maury Street Separation Project	Separates combined sewers into separate sewers for the conveyance of sanitary sewage and storm water to eliminate discharges of combined sewer overflows from this CSO area into the James River. Part of the project for Separation of Select CSO Basins (#III-5) in the City's Long Term Control Plan.
8. Orleans and Nicholson Street Separation Project	Separates combined sewers into separate sewers for the conveyance of sanitary sewage and storm water to eliminate discharges of combined sewer overflows from this CSO area into the James River. Part of the project for Separation of Select CSO Basins (#III-5) in the City's Long Term Control Plan.

PROJECTS	DESCRIPTION
9. Peripheral In-Line Flow Equalization at Oakwood	Captures and stores combined sewage in excess of the capacity of existing conveyance system, and conveys it to the WWTP once the conveyance and treatment capacities are restored. It attenuates peak combined sewer flows, provides a relatively constant flow into the WWTP and thus reduces the size and cost of treatment facilities.
10. Solids and Floatable Control Regulator for CSO Outfall No. 012	Provides solids and floatables treatment for CSO Outfall 012 prior to discharge to Almond Creek and the James River. Part of the project for Solids and Floatable Control Regulators (#III-7) in the City's Long Term Control Plan.
11. Solids and Floatable Control Regulator for CSO Outfall No. 014	Provides solids and floatables treatment for CSO Outfall 014 prior to discharge to Manchester Canal and the James River. Part of the project for Solids and Floatable Control Regulators (#III-7) in the City's Long Term Control Plan.
12. Solids and Floatable Control Regulator for CSO Outfall No. 039	Provides solids and floatables treatment for CSO Outfall 039 prior to discharge to Gillies Creek and the James River. Part of the project for Solids and Floatable Control Regulators (#III-7) in the City's Long Term Control Plan.
13. Lower Gillies Creek Conveyance System Project	Conveys combined sewer flows from the lower portion of the Gillies Creek CSO district to WWTP, and control these CSOs to 4 overflows per year. Conveys combined sewer flows from CSO Outfall 034 to Shockoe Retention Basin to reduce discharges of combined sewer overflows from this CSO area into the James River.
14. Wet Weather Flow Improvements at the WWTP: Solids Removal Improvements Project	Upgrades the primary treatment facilities to provide reliable treatment of up to 140 MGD wet weather flow; upgrades solids handling facilities to handle an increased solids loading associated with the increased CSO wet weather flow treatment.
15. Wet Weather Flow Improvements at the WWTP: Wet Weather Disinfection Facilities Project	Maximizes the wet weather treatment capacity to 300 MGD at WWTP; controls Gordon Avenue (CSO 021) outfall to 4 overflows per year. Upgrades the coarse screens, primary grit removal facilities, Main Pumping Station, and fine screens to provide reliable treatment of up to 300 MGD wet weather flow; Constructs a new wet weather disinfection facility at WWTP to treat flows up to 215 MGD (55 MGD primary effluent plus 160 MGD wet weather flow)
16. Wet Weather Flow Improvements at the WWTP: Expand Secondary Wet Weather Flow Treatment Project	Installs sedimentation enhancing technologies such as inclined plate settlers in the Final Sedimentation Tanks to increase the solids capture efficiency for up to 85 MGD wet weather flow; upgrades the return sludge and sludge withdrawals to increase the capacity of this facility.

PROJECTS	DESCRIPTION
17. Shockoe Retention Basin: Adapt Existing Basin for Pass Through Wet Weather Flow Project	Modifies Shockoe Diversion Structures, including trash rack improvement, solids removal and cleaning of Shockoe retention basin and diversion structure; Reconfigures aeration piping; Modifies retention basin bottom to slope to drain gates; Provides potential flushing system to clean the retention basin and diversion structures after every storm event.
18. Shockoe Retention Basin: Shockoe Retention Basin 15 MG Expansion Project	Expands the Shockoe Retention Basin by 15 MG; Provides flushing system; Relocates outfall to east end of retention basin; Provides access for servicing and mechanically cleaning the retention basin.
19. Shockoe Retention Basin: Shockoe Wet Weather Disinfection Facility Project	Provides disinfection for the new Shockoe outfall CSOs to decrease bacterial loading to the James River by an 80% event mean reduction

APPENDIX C

Wastewater Treatment During Wet Weather: The City shall operate and maintain its treatment works to treat as much flow as possible during combined sewer overflow treatment conditions. The City shall prepare an operating and reporting plan for maximizing treatment during combined sewer overflow treatment conditions and submit that plan to DEQ within 90 days of the effective date of this Order. The following annual average concentration limits shall apply for flow rates above 75 mgd during any calendar year:

Flow Rates	Effluent Limit mg/L [(1)]	
	CBOD5	TSS
Greater than 75 mgd less than or equal to 80 mgd	15	26
Greater than 80 mgd less than or equal to 85 mgd	18	35
Greater than 85 mgd less than or equal to 90 mgd	20	42
Greater than 90 mgd	21	51

(1) Annual average (i.e. average over the number of days in any flow tier)